DOCUMENT RESUME

ED 156 175 IR 006 167

AUTHOR Muller, H.; Thiele, G.
TITLE State-of-Art Survey on Technology and Use of Roll Microfilm, Microfiche and Other Microforms.
INSTITUTION United Nations Educational, Scientific, and Cultural Organization, Paris (France).
REPORT NO COM/WS/325
PUB DATE Jan 74
NOTE 81p.

EDRS PRICE MF-$0.83 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Diagrams; Documentation; Flow Charts; Information Centers; International Programs; *Microfiche; *Microfilm; *Microforms; *Microreproduction; Reprography; State of the Art Reviews; *Technology

ABSTRACT

Benefits which working with microfilm-forms (roll film, microfiche, or aperture card) offer for archives, libraries, and documentation centers are presented, as well as means (processes, instruments, materials) which can be employed in the field of microfilm technology for UNESCO's international information exchange in education, medicine, the natural sciences, and in connection with other cultural organizations. The importance of standardization and compatible equipment and products in the functioning of a universal information exchange is emphasized. Separate sections provide descriptions with diagrams and flowcharts of microform processes, equipment, materials, and technology, and a brief discussion of standards. Appendices include lists of manufacturers of microform equipment, recommendations and standards from several sources, and a key to abbreviations for reprographic institutions and societies. (Author/CMV)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED156175

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

COM/WS/325
Paris, January 1974
Original: English

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

STATE-OF-ART SURVEY ON TECHNOLOGY AND USE OF ROLL MICROFILM, MICROFICHE AND OTHER MICROFORMS

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
Edward Wegman

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

by

Dr. H. Müller
(KALLE AG, Wiesbaden-Biebrich, BRD)

and

G. Thiele
(Institut für Dokumentationswesen, Frankfurt/Main, BRD)

Dr. G. Müller
(for the International Council on Reprography)

* This text is reproduced as a working document in the English version submitted by the International Council on Reprography.

Paris, Unesco, 1974

Reproduced in Microfiche by permission
of UNESCO

IR000167

PREFACE

This study carried out by the International Council on Reprography was commissioned by Unesco to meet the growing need for a survey of the present state of the technology of the various microforms (microfilm, microfiche, etc.) and their use for documentation, library and archives work. Developments reported at the European Microfilm Congress held at the end of 1972 are included.

The authors, Dr. G. Müller, (Treasurer of the International Council on Reprography and President, German Committee for Reprography), Dr. H. Müller, (KALLE AG, Wiesbaden-Biebrich, Federal Republic of Germany), and G. Thiele (Institut für Dokumentationswesen, Frankfurt/Main, Federal Republic of Germany), are specialists in reprographic techniques and their applications for information purposes.

This survey is intended for documentalists, librarians and archivists and other information specialists who supervise microcopying units in their institutions or who apply and use microform technology, and for the technicians responsible for the organization and maintenance of microcopying units.

REPROGRAPHY IN DOCUMENTATION AND LIBRARY SERVICES

I. TECHNOLOGY AND USE OF ROLL MICROFILM, MICROFICHE AND OTHER MICROFORMS

PROJECT

INTRODUCTION 7

A. PROCESSES

A.1. Recording processes for literature 11

A.1.1. Filming bound journals and books 11

A.1.2. Loose leaf filming (manuscripts) 11

A.1.3. Filming with special markings (coding) 13

A.1.4. Aperture Cards 14

A.1.5. Jacket Microfilm 14

A.2. Duplicating processes for microfilm 15

A.2.1. Silver salt processes 15

A.2.2. Diazo processes 17

A.2.3. Vesicular processes 19

A.3. Re-enlargement processes for microfilm 20

A.3.1. Silver halide processes 20

A.3.2. Diazo processes 21

A.3.3. Electrophotographic processes 21

A.3.3.1. Processes using transfer (toner image transfer processes) 21

A.3.3.2. Direct processes 22

B. **EQUIPMENT**

B.1. Cameras 25

B.1.1. Planetary Cameras 25

B.1.2. Cameras for Microfiche 26

B.1.3. Rotary Cameras 27

B.2. Processors 28

B.3. Duplicating Printers 30

B.3.1. Silver Film Printers 32

B.3.2. Diazo Film Printers 32

B.4. Readers 35

B.5. Microfilm Printers and Reader Printers 36

B.5.1. Chemical Process 36

B.5.2. Electrostatic Process 37

B.5.3. High Volume Microfilm Printers 37

C. MATERIALS

C.1. Silver Halide Material 39

C.1.1. Recording and Duplicating Films 39

C.1.2. Enlargement Materials 39

C.2. Diazo Materials 40

C.3 Electrophotographic Materials 41

D. TECHNOLOGY 43

E. STANDARDS 48

F. SUPPLEMENT 51

LIST APPENDIX

List Nr.	Microfilm Equipment	
1	Microfilm Planetary Cameras	51
2	Step & Repeat Cameras Microfiche, A6 - Size	52
3	Rotary Cameras, 16 mm	53
4	Microfilm Processors	54
5	Microfilm-Diazo-Duplicating Printers	56
6	Manufacturers of Microfilm Readers	58
7	Reader-Printers	60
8	Microfilm Enlarger-Printers	61

Microfilm Standards

9	ISO-Recommendation TC 46 / SC 1	62
10	British Standards	63
11	Norm Française	64
12	German Standards	65
13	U.S. American Standards	68

Miscellaneous

14	Trimmed Sizes ISO R 216 - 1961	70
	Metric Conversion Table, Paper Size, Film Size, Film Thickness	71
15	Reprographic Institutions, Societies etc.: Abbreviations	72
16	Flowchart Symbols	76
17	Literature	80

STATE-OF-THE-ART SURVEY ON RESEARCH AND DEVELOPMENT IN DOCUMENTATION

REPROGRAPHY IN DOCUMENTATION AND LIBRARY SERVICES

I. TECHNOLOGY AND USE OF ROLL MICROFILM, MICROFICHE AND OTHER MICROFORMS

Introduction

The purpose of this study is to present the benefits which working with microfilm-forms (roll film, microfiche or aperture card) offer for archives, libraries and documentation centres and to record what means (processes, instruments and materials) can be employed in the field of microfilm technology for the international information exchange of UNESCO in education, medicine, the natural sciences and in connection with other cultural organisations. The study takes into account the state of development as presented at the European Microfilm Congress at the end of 1972.

The progress of technology and the constantly rising standard of living throughout the world necessarily requires new foundations of educational establishments, high schools, hospitals and institutes. Every new foundation requires reference works, hand books and specialist journals in order to draw on existing experience. For purely economic reasons alone it is no longer possible to produce, procure, store and utilize these documents, on a world-wide basis, in their printed form or reproduced in a 1:1 ratio. The only way out is the use of microforms. These microforms provide the necessary basis for teaching and for research.

The technical development aid which must be provided to certain countries demands that working documents, (for example in the form of collections of data and technical drawings), be made available in a complete form for whole fields of manufacturing as well as pecific projects, before it is possible to erect power stations or factories. This again is probably only possible with the aid of microfilm systems.

Four aspects must be borne in mind:

The source of information must provide:

- reliable and clear literature and document collections in form of microfilm.
- appropriate duplicating and selection methods which, in areas which have reached a high state of development, are coupled with one another, for example microfilm with electronic data processing, in order to comprehensively provide the entire documents for certain projects under different headings.

The recipient of the information:

- must have Appropriate reading and evaluation devices available.

- must himself be able to employ the microfilm as an economical internal tool and must be able, if appropriate, to pass his own results and experience over to a central point, for example UNESCO, by means of microfilm.

The primary tasks are: the exchange of information resulting from experience, the recording of information, and the reduction of the voluminous documents of various kinds (for example printed reports, books, literature extracts, theses or technical drawings). Hence, microfilm is a method which can be used immediately in information transmission and information processing in order to gain a grip on a possible flood of information at the very start and speed up the flow of information. Thus, microfilm serves to keep the constantly growing flood of paper under control.

In order to be able to provide stored information quickly and without great expense to interested parties throughout the world, certain basic rules and standards must be recorded and observed.

New processes have valuably supplemented existing processes in recent years. Further possibilities exist, since microfilm processes are so flexible that they can, on the one hand, be adapted to suit existing forms of organisation, whilst on the other hand they make it possible to find simplified forms and to save costs. At the present time, a combination with computer technology already offers scope which will gain in importance in the future. Whilst for retrieval an electronic computer installation requires least time, microfilm offers the possibility of considerably greater storage capacity than magnetic storage.

This study is intended to present the technical scope and economics of microfilm.

In order to carry out microfilming of literature and technical drawings, it is necessary to incorporate microfilming organisationally into the flow of information. Official authorities and administration organisations, libraries and documentation establishments cannot simply utilise microfilm as a tool by procuring a number of recording and reading apparatuses and making these available. Rather, a system must be worked out and built up. This means, under certain circumstances, that changes in organisational procedure and working procedure must be made. The department responsible for this must examine the working procedures, storage and possible access to the information in order to find the most appropriate form of use of microfilm. The microfilming itself must be fitted in at as early a stage as possible, that is to say at the first "traffic centre" of the central collection system. For example, this stage can be reached, when drawing up a report, when the contents of the latter are no longer being altered.

Given good organisational arrangements, the advantages of microfilm are:

- Rapid access to the information (short lines of communication and rapid provision of answers).

- Optimum space saving (because only items undergoing their first processing need be in the original form).
- Rapid and cheap distribution of information by means of duplicate film.
- Flexible classification possibilities.
- Time saving.
- Weight saving if despatched by air mail.
- Duty saving.
- Reduction in production costs through saving paper, since in many cases only certain parts of a report are required in the original size.
- Greater storage density than with other storage media.
- Reduction of the work load of electronic data processing, and supplementation of the scope of the latter, when used in combination.
- Security of documentary contents against loss, forgery, damage or destruction, through the production of non-fading duplicates which can, without great cost, be stored reliably in a separate location form the originals.

The technologies underlying microfilm as a working instrument and a means of information are:

- Photographic technology and its numerous possibilities for size reduction to below the limit of visibility to the naked eye.
- Duplication of microfilm, (that is to say the possibility of microfilm copying).
- Re-enlargement to the original size, and its copying.
- Retention of legibility through all intermediate steps.

Summarizing, it can be stated that, given the present-day production of information, storage in the minimum space, with scope for rapid accessibility and distribution, is necessary. This requires the use of microfilm systems. In addition to questions which relate to the selection of the system, the functions of the technical part are of decisive importance. Different filming systems and different reduction and enlargement factors are used in various countries of the world and give different products. However, a universal information

exchange can only function if systems are employed whereof the equipment and products are compatible and can be employed equally well for questions of the technical-scientific nature and for exchange of information on cultural questions. This is only possible by means of standard specifications which in part still require to be developed on an international basis. The recommendations contained in chapter E are intended to serve this purpose.

The successfull use of microfilm depends on the organisation. Careful examination of the information sequences must provide a clear picture as to the possible uses of microfilm. The systems employed must take this objective into account. For example, it is necessary to take note of the extent to which documents with single-sided and double-sided text are to be microfilmed. Only thereafter is it possible to decide what filming method (microfiche or roll film; simplex, duplex or duo) is to be employed. The choice of equipment also depends on the amount of recording, duplication and re-enlargement which is required. The number of documents and the frequency of access to the individual documents are important points. In order to be able to define and calculate the personnel and amount of material required, it is necessary not only to know the required output (printed matter or drawings), but also to have an analysis according to sizes.

In reaching a decision as to which systems, which equipment and which materials are to be employed, it is furthermore necessary to take into account whether what is concerned is:

- pure archives work, that is to say microfilming of files, documents, cartographic drawings and technical items, or

- library work, that is to say, filming of publications, reference works or handbooks, or

- general documentation, where rapid access to information becomes necessary, e.g. government bodies, commercial organizations or institutes, health organisations, agricultural or forestry organisations, or patent offices.

It is necessary to examine to what extent certain processes can be employed, if, in special cases, film is stored and processed under extreme climatic conditions; and it is also necessary to examine the equipment maintenance and service situation. Undoubtedly, the objective should be to design the ideal technical system, but rough everyday usage must be borne in mind.

For countries which are starting to establish microfilm archives and equip themselves for microfilming, it is undoubtedly advisable to commence with a simple and reliable set of equipment. It should take into account the ability of the operating personnel and training requirements, and also the availability, extent and dependability of technical service. The more one becomes dependent on a fully automatic system, the more precarious becomes the situation with regard to servicing and availability of spare parts and replacement parts. On the other hand the standards demanded in respect to training and availability of operating personnel can be lower where automatic equipment is used, provided reliable servicing of the equipment is available.

A. PROCESSES

A. 1. Recording processes for literature

As already reported in the introduction, there can be greatly differing reasons for the use of microfilming. On the one hand, it can serve as a safety measure for documents, whilst on the other hand it can also be employed to solve specific problems. Both will influence the choice of the microfilm process. Furthermore, the recording process is influenced by the size a condition of the documents.

A. 1.1. Filming Bound Journals and Books

A planetary camera must be used to film permanently bound documents, such ase journals, magazines and books. The originals are placed on the camera copytable individually, or if in a book cradle, are in most cases pressed from below against a glass plate in order to keep the pages which have been opened as flat as possible. The exposure is then taken. The film transport subsequently takes place automatically. After turning the page, the next exposure can be triggered manually.

Cameras of this type have hitherto mainly been offered for 35 mm film. Only recently have 16 mm planetary cameras also been marketed.

The journals and books filmed by this process usually have a sequential page numbering. It is necessary — and this is also pointed out in appropriate standard specifications — that the page sequence be retained on the film in order to permit continuous reading by the user, as in the original.

Setting out manually, and turning the pages, are the time-determining factors in this recording process. Hence, only a low filming output is achievable.

A. 1.2. Loose-leaf Filming (Manuscripts)

The filming of loose leaves, for example manuscripts or documents, can be carried out in accordance with the same stepwise process. However, it is speeded up considerably, and thus made more economical, in a 16 mm rotary camera. Such equipment differs even externally from the planetary equipment. The original to be filmed is introduced into a slit where a trigger initiates the subsequent process sequence. The original is passed uniformly in front of a light source. It is photographed synchronously on a film via an objective and mirror. Thus, one original after another can be introduced in very rapid sequence, and be filmed thereby. When filming originals of entirely similar nature, for example A6 Card Index cards or payment documents, a whole packet of such originals can be inserted into a so-called automatic feeder. The equipment then automatically takes one original after another for a

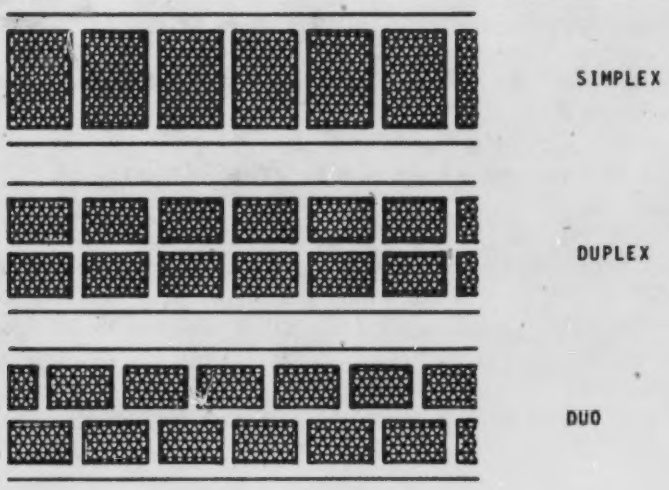
completely continuous process sequence.

Certain rotary cameras of this type now have a film developing unit built into the same piece of equipment, so that the film is produced already dried, processed to archival standards and suitable for immediate use.

Many of the cameras possess a variety of reduction. As a result it is possible to suit the recording technique to the size of the original, or to increase the storage density.

In the case of some equipment it is furthermore possible to expose two films simultaneously so that one of the films can be used as the security film and the other as the working film.

There are three possible frame arrangemants for filming on 16 mm film:



1. 16-mm-microfilms
   Image positioning techniques, rotary cameras

In the standard process (Simplex process) it is possible to photograph one A4 document next to the other. Using a reduction of about 1:20; a 30 m film holds about 2,600 documents.

technique / reduction / Size of documents	Simplex 1 : 20	Duplex 1 : 40	Duo 1 : 40
A 3	1 360	2 600	5 200
A 4	2 600	4 800	9 600

2. Capacity of Microfilm, 30 m x 16 mm, belonging to different image positioning techniques

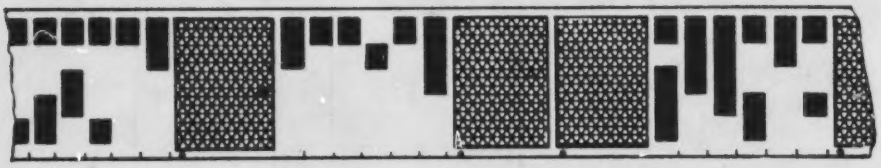
Using the duplex process, the front and back of a document are photographed next to one another on the film, using a mirror system, the reduction in that case being about 1:36.

A third possibility is the dual process in which half the width of the film at a time is exposed, in two passes, using about the same reduction.

A. 1.3. Filming with special marks (Coding)

In the field of documentation, documents relating to one subject field are generally collected and classified according to their contents. When photographing such document collections, and in view of the constant resort to microfilm, the retrieval represents a particular problem. There are various solutions for this. These will be presented in a subsequent study. In the present article, we are restricting ourselves to a single example.

Particular difficulties arise if the documents stored on the film are to be researched for a particular subject, a fact or even particular combinations. This is only possible if the documents have been previously classified and, when they are photographed, this classification is also photographed onto the microfilm in the form of a code. This optical code — in most cases in the form of black and white squares — must be recorded on the film during the photographing process.



3. Binary coded film

This requires a special camera design for every system which works with coded microfilm. In most cases, the codings are included on the film, using a planetary camera, by additional photographing of a lamp field or of a light field covered by a mask.

A. 1.4. Aperture Cards

Photographs are taken with a planetary camera on 35 mm film, and after developing the film frames are divided up and mounted in aperture cards, or are copied image-wise, as roll film, onto diazo duplicate cards. Using processor cameras, it is possible to produce aperture cards continuously, without intermediate steps, when taking the photograph. This process is used for filming of drawings and patents.

The aperture card offers the possibility of firmly tying a single microfilm frame of the 35 mm film or a small number of images of the 16 mm film to an index card which possesses an appropriate aperture. This index card, which is generally in the form of a machine punched card, can be inscribed manually or with a typewriter, or can be punched in the usual manner. In that case, the text can be written on the top edge of the card by a punch code translator. Whilst a frame of the finished rollfilm is mounted in the aperture card, the duplicate card, in the unused state, contains a piece of light-sensitive diazo film which is then exposed in the aperture card by the contact copying process and is developed. These copycards serve to produce duplicates of aperture cards or to produce aperture cards from an uncut roll film, using a roll-to-card printer. In that procedure the film section to be copied is located by means of the screen and is then transferred, in the same unit onto a copycard. The process is of particular interest for filming patents and drawings.

A. 1.5. Jacket Microfilm

Film strips can be introduced into transparent jackets which carry a heading strip for inscription. These are manufactured in various card index sizes, perferably in A6 size, in punched card size, and for all film widths (including mixed widths). For inserting the film

into the jackets, there are jacket-filling devices, in most cases combined with a reading apparatus and a film cutter. They also permit further inserting, that is to say supplementing and replacing strips and individual frames. Transparent jackets are used as original cards; the working items are the duplicates on diazo- (or vesicular-) material, produced therefrom. Admittedly, only transparent jackets in which one of the films is very thin can be copied by the contact process onto sheet-films (microfiches).

(Illustrations of the different microforms see chapter B. 3., Duplicating Printers, pages 30/31

A. 2. Duplicating Processes for Microfilm

A particular advantage of the microfilm systems is the possibility of producing duplicates of all forms of microfilms and in this way to be able to exchange information, through microfilm, with as many participants in the system as may be desired.

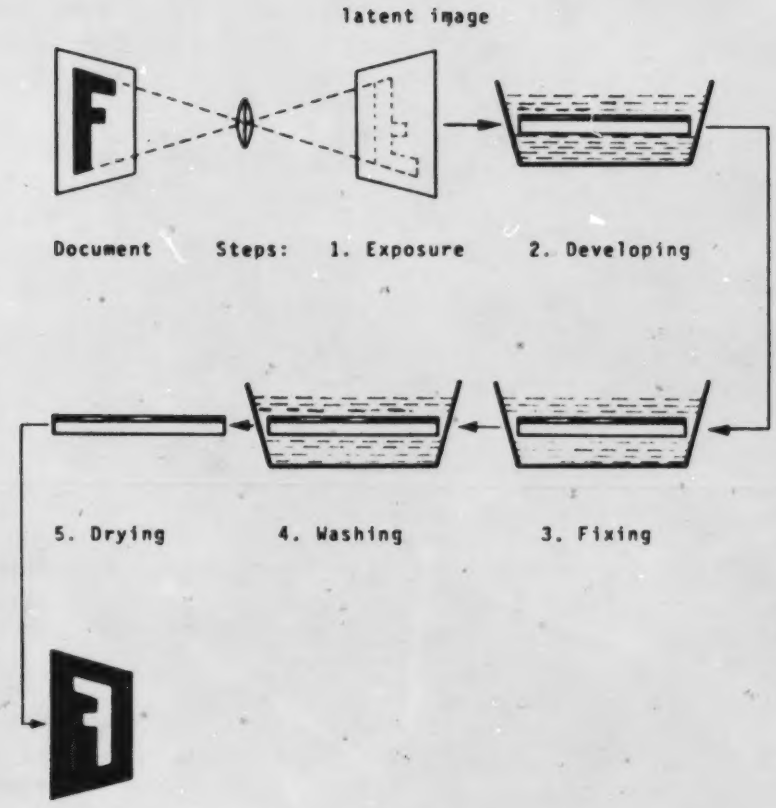
Hitherto, duplication of microfilm has usually involved only a few copies of each frame; but a distinct change can be noted at the present time, particularly in the area of microfilming high-usage reference publications. Systems are already in use in which handbooks, lists and catalogues have been distributed, through microfilm, in editions of up to 10,000. Microfilm thereby enters fields which have hitherto been the preserve of printing technology.

The application of advanced microfilm technology has resulted in increasing the production rate of publications in this medium. Intermediate stages using paper can be circumvented by issuing the data directly on microfilm, viz. Computer Output Microfilm (COM). It is now possible to combine microfilm with electronic data processing, automated typesetting, storage and retrieval systems and data banks.

Depending on the problem, different processes and equipment are required. Furthermore, in the case of large publication editions, intermediate copies must be provided. The technology and production methods of central microfilm establishments with high copy outputs are comparable with central copying laboratories, for example for cinefilm.

A. 2.1. Silver Salt Processes

Copying films of high resolution are employed, the processing of which basically agrees with that of the films used for photographing; hence, the same developing equipment, with the same chemicals, is used for developing the copies.



4. Silver-sensitized Photography

Different working conditions are required only if reversal developing is demanded in order to obtain duplicates of the same character. Since the number of baths is greater, and a subsequent exposure is necessary, special machines must be employed for this purpose.

On the other hand, it is more appropriate to employ, for duplicating, special reversal films which can be processed in the normal way and which, because of their different chemical make-up, yield duplicates of the same polarity directly (non-reversal film, direct positive film or direct duplicate film).

Silver halide films usually reverse the polarity, that is to say, on copying from a negative a positive copy is obtained, or vice versa. They are therefore particularly suitable for requirements in the field of documentation if, in addition to text, pictorial material is also to be reproduced. For utilisation in reading equipment, the user must be provided with a positive copy if continous-tone images and illustrations are important parts of the literature.

If few copies of original films are required, the positive copies will be taken directly on silver duplicating films. On the other hand, if many editions are required, it will be preferable to choose the method which uses a silver intermediate master and duplication via diazo films, since these materials are less expensive.

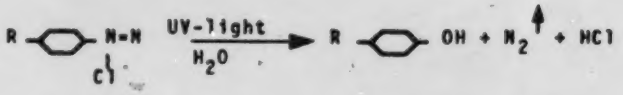
Colour microfilms are now being offered for certain scientific fields. Negative material is used to take the photograph, and diapositive copies are then taken from this by a contact process. Preferred fields of use are in education and medicine. The microform chosen is microfiche. The photographing and processing of microfilm colour materials is considerably more complicated than for customary black and white films. At the present time it must be carried out in special equipment or special laboratories operated by the film manufacturers.

Microfilms are usually copied by contact processes. By means of optical copying with silver film, it is possible to convert the film size from 35 mm to 16 mm or vice versa. However, this is only used in special cases.

A. 2.2. Diazo Processes

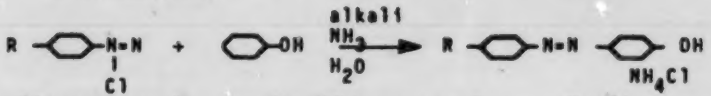
Diazo microfilms are derived from the known diazo papers. The light-sensitive substances used are various diazonium salts which decompose under the reaction of ultraviolet light, liberating nitrogen. This is utilised in the vesicular process. The salts not exposed to light are able to form strongly coloured and light-fast azo dyes with so-called coupling agents in an alkaline medium. In general, the dry diazo process is used.

1. Light-Decomposition of Diazocompounds



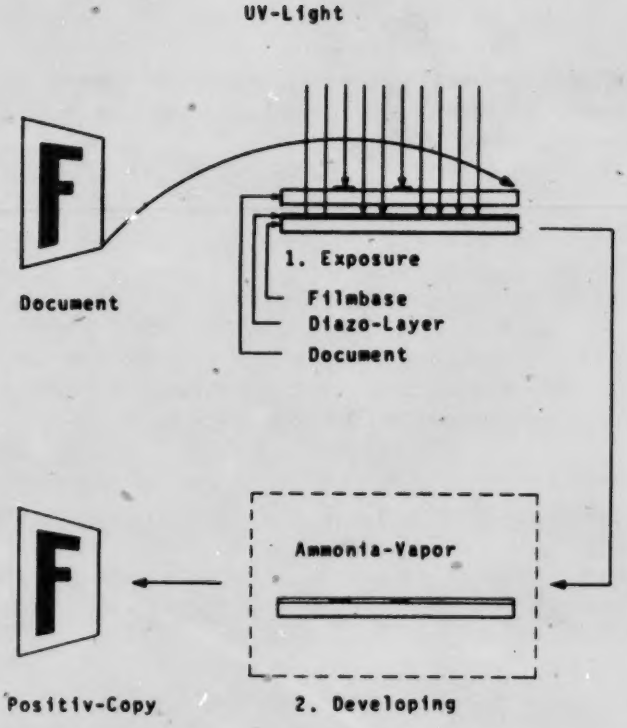
Diazocompound Bleaching Product

2. Dyecoupling



Diazocompound Coupling compound Azo dye

5. Diazo-Process



6. Diazocopying, Dry Development

Diazo films can be handled in daylight. Hence, the use of the duplicating equipment is particularly simple. Diazo films are in many cases to be found in workrooms, archives or registries directly alongside the microfilm files, so that requests for copies can be handled very simply.

Almost all diazo duplicating printers are automatic units, either single or in combination, in which a finished copy is produced in a single pass or in two process steps. Depending on the amount of work called for, different capacities of output are offered, but even in small copiers, for example for microfiche, a duplicate can be produced in a few seconds.

In accordance with the diazo process, the equipment can be divided into a copying part and a developing part. In the copying part, the film original is exposed, in direct contact with the diazo film, using mercury high pressure lamps; thereafter development is carried out in an atmosphere of ammonia vapour. In one variant of the process, the coupling agent is not contained in the coating but is applied as a solution after exposure. This so-called semi-dry diazo process is not used widley for microfilm duplication in contrast to the dry process described above.

A. 2.3. Vesicular Processes

In this process, similar light-sensitive systems to those in the diazo process are used. However, the essential difference is that it is not the formation of dyestuff by a coupling process, but the nitrogen liberated during the exposure, which is employed to construct the image. This is because the light-sensitive diazo salts are embedded in a thermoplastic layer from which the nitrogen that is liberated can only escape very slowly. If this layer is heated briefly after image-wise exposure, very fine gas bubbles form, which render the layer opalescent. This is followed by a stabilising step. Therein, the residual diazo salts are decomposed by an intense post-exposure. The gases produced gradually diffuse out of the layer. This process can only be employed if precise processing conditions are observed.

In contrast to the normal diazo process, this process produces the image in the location where light-sensitive substances have been decomposed. The vesicular process thus reverses, that is to say, a positive duplicate is obtained from a negative master. Thus it is possible, in principle, to achieve the same effect as with the silver duplicate film described above. Admittedly, the vesicular film does not achieve the gradation and quality of a silver film image.

The vesicular process is above all distinguished by the fact that it is completely dry and works without chemicals. All that is required for the equipment is a simple connection to the mains.

A. 3. Re-enlargement Processes for Microfilm

Microfilm technology would be incomplete without the possibility of reproducing the photographed documents on paper, in original size. Practically all reprographic processes are suitable for this purpose.

A. 3.1. Silver Halide Processes

The silver halide process is used at the present time firstly for enlargements required in small numbers, and secondly if particularly high quality is to be achieved when reproducing continous-tone originals on microfilm. This requires working in a standard photo dark-room. The microfilm image is enlarged onto the silver-salt paper by means of an enlarger. In addition to the normal photographic enlargers there are also special models for the enlargement of microfilms which are distinguished by extremely hard and sharp reproduction and use special lenses and a point light arrangement. The silver-salt paper is developed in the usual way with photographic developers (see also figure 4). However, special technical papers and developers have been made particularly for microfilm. In order to ensure that the copies are light-fast, they must be fixed and subsequently washed, during which all chemicals are elutriated both from the gelatine and from the paper. Only in this way is the requisite long working life (archival quality) of documents achievable. Drying of the papers is generally carried out on a drying press or drum.

Since this sequence is very time-consuming because of the prescribed long dwell time in the baths, the industry has achieved a shortening of the process in the so-called two-bath process. Here, the processing is carried out in an apparatus which — as the name implies — is equipped with two baths through which the paper is passed automatically. In the first bath, developing is carried out with a very high speed developer which in this process is called an "activator". The subsequent "stabiliser" bath serves to stop the developing process abruptly and to neutralise the chemicals still present in the paper. An enlargement produced in this form in about two minutes has practically archival quality. However, colour changes due to humidity factors can occur. If it is desired to eliminate this possibility entirely, the copy must, some times after being finished, be placed once again in a photographic fixing bath and be dried after adequate washing. It is then as durable as a silver salt enlargement produced by the conventional process.

For both processes there exist, alongside normal enlarging papers, further materials such as paper coated on both sides or card-thickness paper, or translucent and optical clear layer carriers based on plastics, such as triacetate film or polyester film.

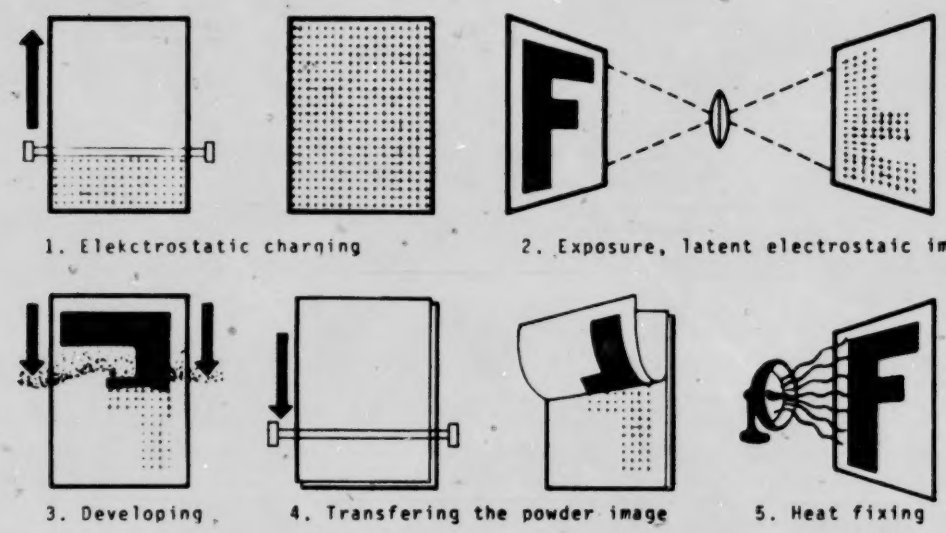
In addition to the hard-copying materials usually employed for microfilm enlargements, continnous-tone materials are offered for special cases.

A. 3.2. Diazo Processes

The diazo enlargement instruments previously used are hardly of any further importance at the present time, since they are uneconomical in operation due to excessive exposure times.

A. 3.3. Electrophotographic Processes

A. 3.3.1. Processes Using Transfer (Toner Image Transfer Processes)

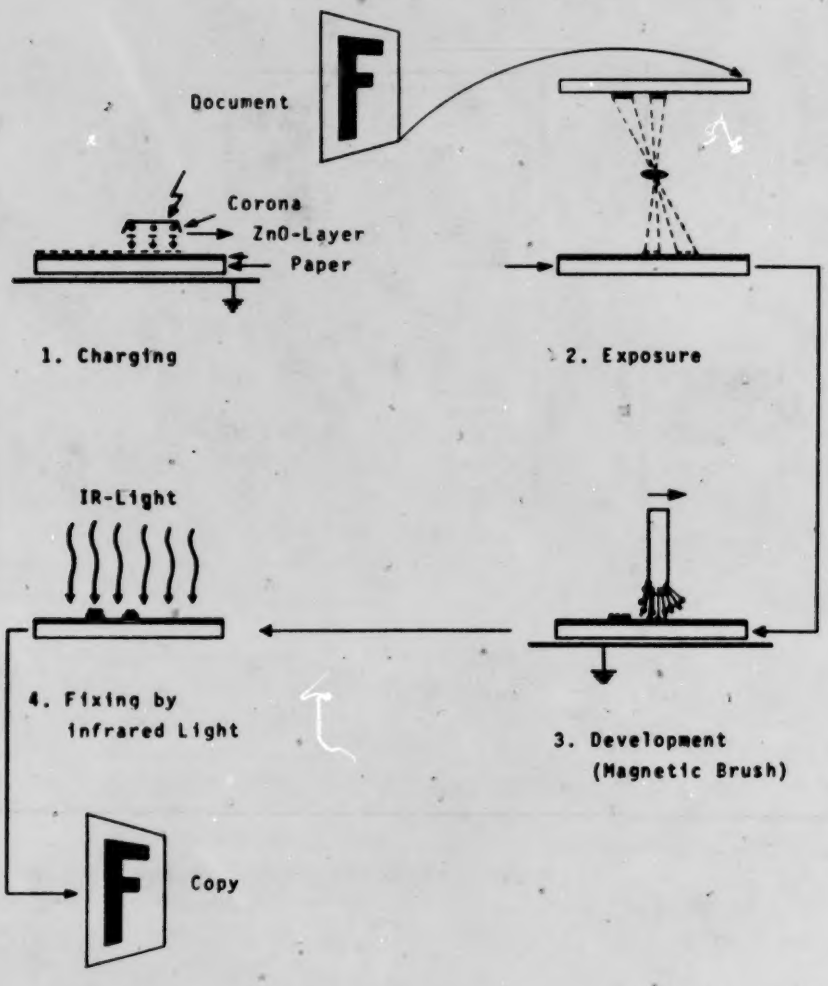


7. Electrophotography, Toner-Transfer-Process

A photo-conductor layer (for example selenium), with which a drum or a belt is coated, is charged electrostatically, exposed and developed with a dry toner. The visible powder image thus produced is transferred onto an uncoated paper and is fixed to the base by the action of heat. In this process it is possible to produce a positive copy from negative microfilms, (that is to say reversal), or a positive copy from a positive microfilm, which requires a change of toner.

A. 3.3.2. Direct Processes

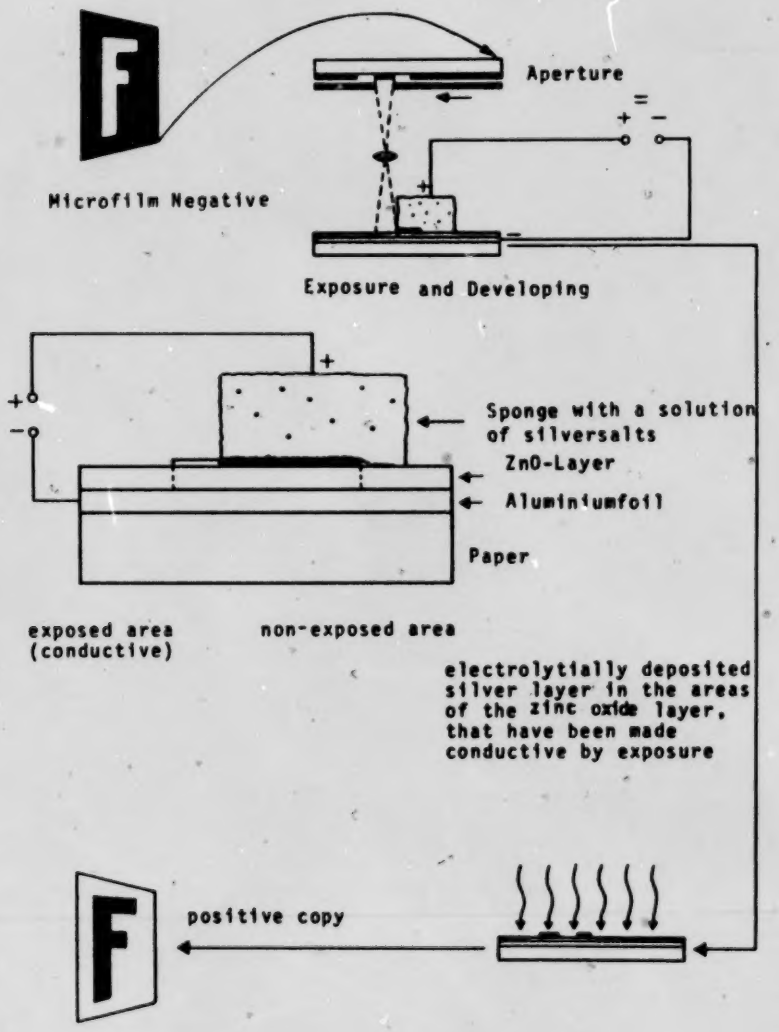
Papers with a zinc oxide coating are used. Before exposure, the papers are negatively charged electrostatically. The transparent areas of the microfilm original produce photo-conductivity on exposure, so that there the electrostatic charge disappears. The latent electrostatic image thus produced is rendered visible by negatively charged coloured particles. These coloured particles can be contained in a synthetic resin powder (dry toner) or in a liquid (liquid toner). Powder images must be fixed by a heat treatment. In this procedure, positive copies are obtained from negatives.



8. Electrophotography
Direct process

If only positive microfilms are available, the toner can be replaced by another with positively charged particles in order to obtain positive copies.

In a variant of the process, a special paper, consisting of a base paper, vapour-deposited metalisation and zinc oxide coating is used.



9. Electrophotography
Conductography

After exposure, a silver salt solution (activator) is applied and from this silver is precipitated onto the latent image under the action of a direct current.

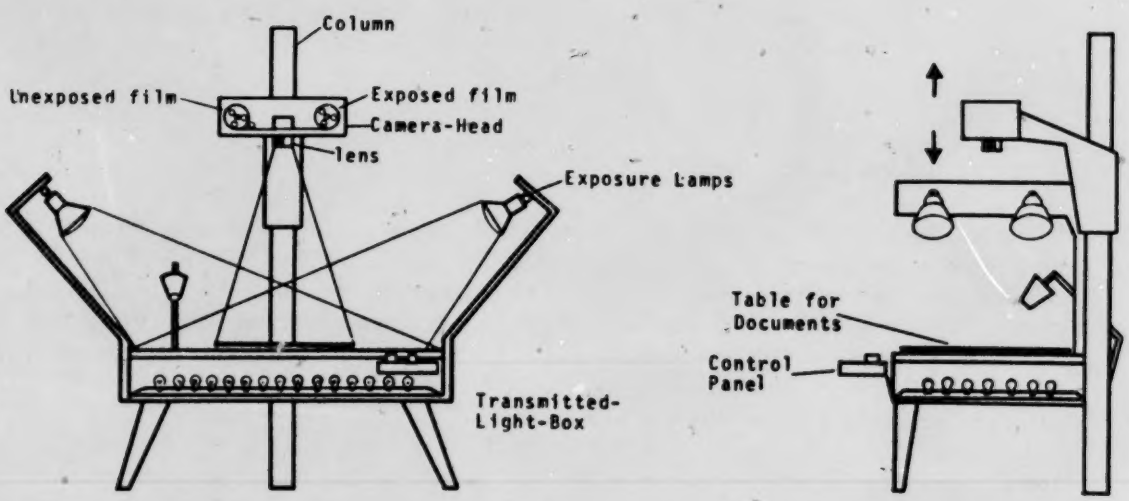
This is again a reversal process so that a negative film gives a positive enlargement and vice versa.

B. EQUIPMENT

B.1. Cameras

Cameras for microfilm have developed from the simplified reproduction apparatuses for photographic cameras. If small quantities of microfilm frames are required, such equipment which is still being offered complete by some manufacturers, can be used. This consist of a table on which the original is placed and which is fitted with lamps at the sides. The camera can be pushed up and down on a vertical column in order to achieve the particular reduction required. In the cameras, this reduction is in most cases achieved by spacer rings between the objective and the camera body. Only in more primitive cases is an adapter lens used. This can have an adverse influence on the quality of the objective. These apparatuses must meet varied requirements and be suitable for the most diverse fields of use.

B. 1.1. Planetary Cameras



10. Planetary Camera

Microfilm cameras must deal with mass filming of documents under standardized conditions. These cameras no longer depend on a perforation at the film edge. They are fitted for working with 30 m rolls of unperforated films. In most planetary cameras it is possible to change the frame-pitch, that is to say the length of the film exposed at any one time. In this way, the frame size can largely be suited to the format of the document and optimum utilization of the film can be achieved.

Since the optical density of the film should be kept constant, image by image, over the entire length, the cameras are fitted with a measuring device for measuring the intensity of illumination. This is used for manual or automatic control of the exposure, either through the shutter speed or through the intensity of illumination.

The table on which the original is placed varies and is at least sufficiently large that A3 or 11" × 17" documents can be filmed. For microfilming bound originals, a book holder is frequently provided underneath the photographing plane, which is intended to provide uniform contact pressure of the pages and to avoid damaging the spine of the book. For microfilming transparent originals, for example technical drawings, this table can also be a lightbox with which it is possible to work both with transmitted light and with reflected light, and also with a combination of both types of illumination. The cameras are provided with a signalling device which indicates the end of the film.

For filming technical drawings, processor-cameras may also be used in which aperture cards with unexposed photographic films are inserted and are completely processed following exposure in the camera unit.
(see List 1)

B.1.2. Cameras for Microfiche

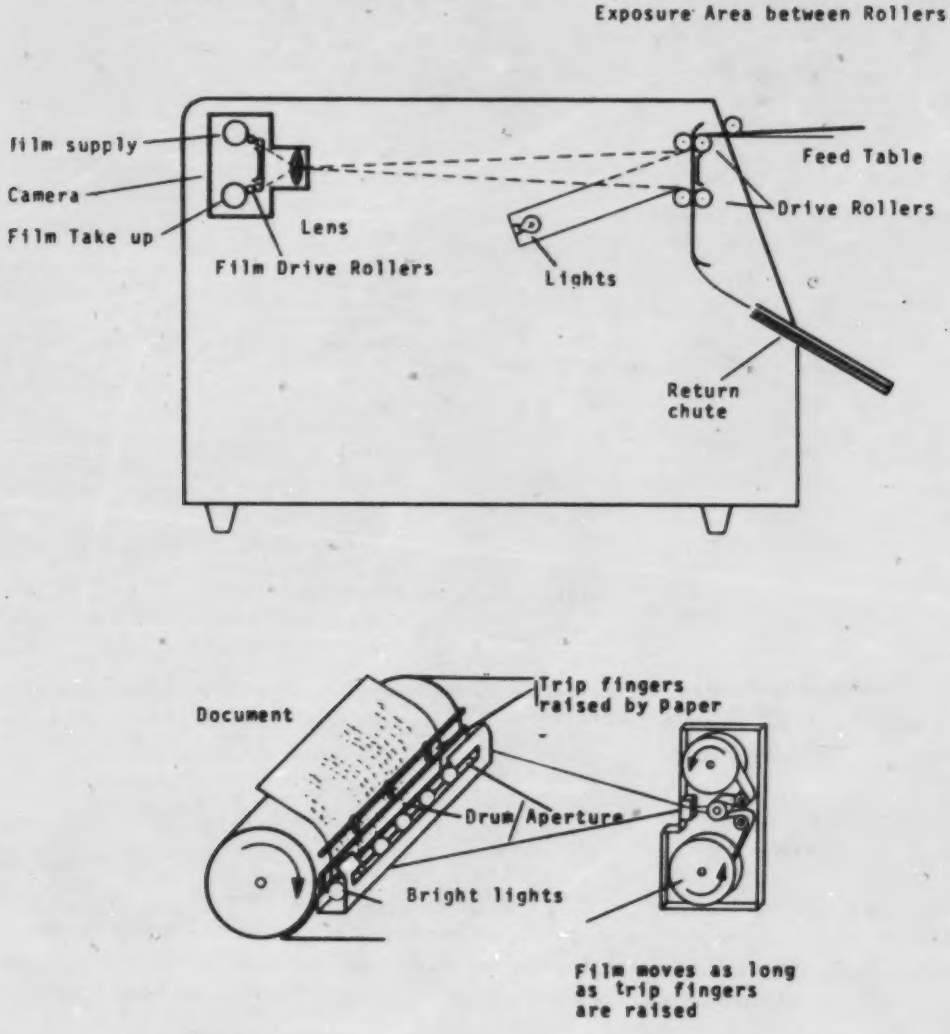
Microfilm cameras for microfiche are fundamentally planetary cameras so equipped that they perform the appropriate phtographing sequence on a microfiche form frame to frame and from line to line. They are often referred to as step-and-repeat cameras. They use a roll of film 105 mm wide on which each microfiche format is exposed consecutively, following which the complete roll of film is processed. The roll is then precision cut into individual microfiche. There are also processor-cameras in which the microfiche are automatically developed and issue dry in a matter of minutes.

The first line of a microfiche is assigned to the title, which is legible to the naked eye. The pre-typed or printed title line is usually photographed through a second objective in the camera and is recorded on the film in approximately actual size.

Sometimes this operation is done in a separate unit and the film sheet is then inserted into the camera where the photographing commences of the documents assigned to that microfiche. Since standards for microfiche are much tighter than for other microforms, the possible adjustments of the microfiche camera are few.
(see List 2)

B. 1.3. Rotary Cameras

Rotary Cameras are predominantly employed for economical filming of unbound individual originals. The individual originals travel through the apparatus by means of a constant speed transport system. The material to be photographed is passed in front of a photographing plane and is exposed — in the reduced ratio — on 16 mm roll film which travels synchronously with it.



12. Rotary Camera, Optical Details

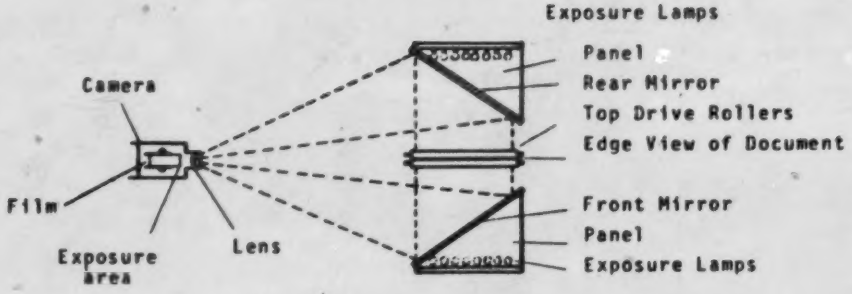
28

For microfilming continuous forms, there are rotary units available which are designed for the peculiarities and dimensions of these forms.

In contrast to planetary cameras, the originals to be filmed and the microfilm are "moving". For this reason, high and therefore economical filming outputs are possible when using rotary cameras. The cameras work, depending on the model of camera, with maximum paper throughput speeds of between 20 and 50 m/minute.

The size of the originals to be filmed depend on the input width of the cameras which may vary between 130 and 400 mm depending on the manufacturer and the model.

Rotary cameras are designed for using several reduction factors, optionally coupled with the possibility of using interchangeable camera inserts.



13. Rotary Camera, Duplex-Exposure

The choice of the microfilming method (simplex, duplex or duo) and the adjustment of the exposure can be achieved with the aid of simple operating devices. In part, automatic exposure control is provided.

B. 2. Processors

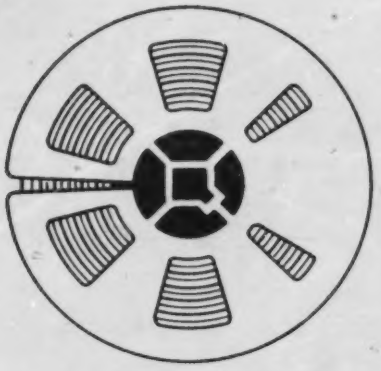
The use of daylight processors offers the most economical form of use for film developing. The water is run in via a mixing control which ensures a constant water temperature and hence adequate washing of the film. If the water conditions are unfavourable, it is advisable to interpose a commercially available continuous flow filter in order to clean the tap water.

The development of filmstrips is also possible with most processors.

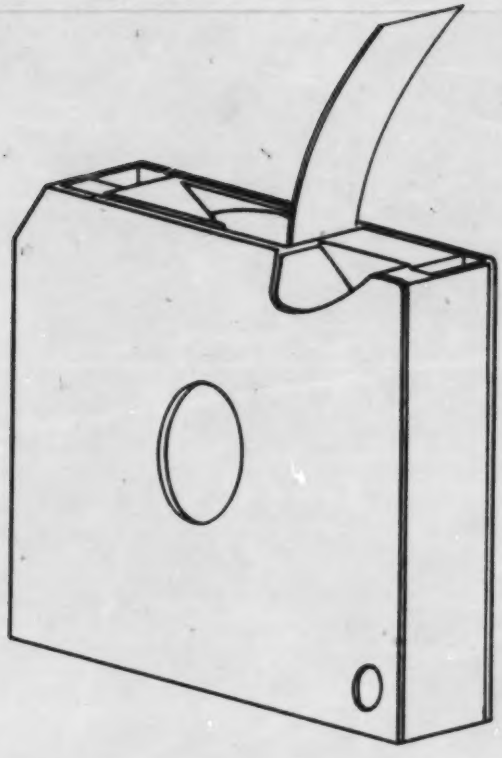
Mechanical developing ensures films of constant quality with minimum expense. If small amounts of film are produced, manual developing with developer cans is also possible. Attention must be given to accurately observing the processing instructions as specified by the manufacturer of the chemicals.

B. 3. Duplicating Printers

The greatly differing forms of microfilm, such as 35 mm and 16 mm roll film

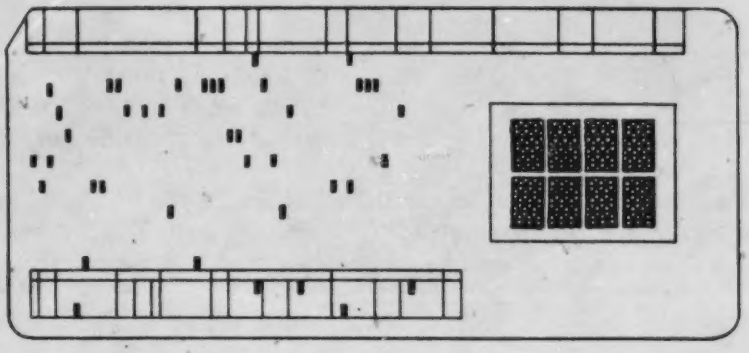


14. Filmreel

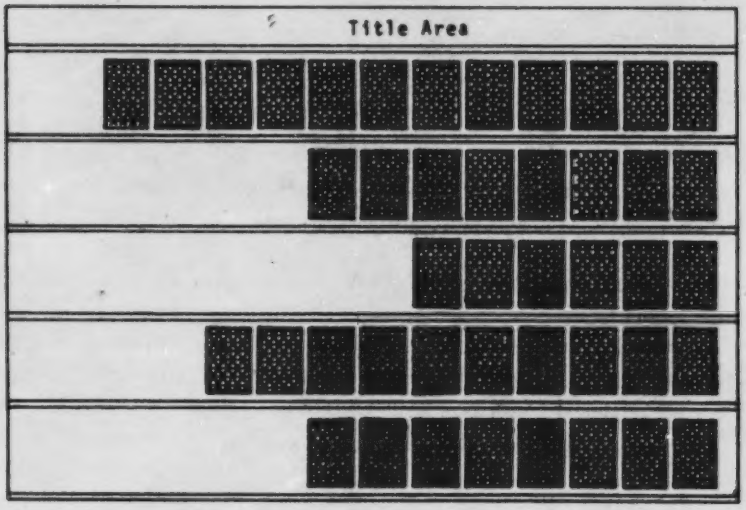


15. Film Cartridge, Film Cassette

Aperture cards



16. Aperture Card, D-Format



17. Microfilm-Jacket

Aperture cards, 105 mm and 180 mm roll film in microfiche systems and A6 michrofiche and Microfilm jackets of various sizes
require equally varied designs of duplicating printers. Greatly differing requirements in output capacity, such as occasional copies on the one hand or micro-publications on the other, lead to equipment designs which also differ greatly in the procurement cost. In the main, the entire range of variations of equipment is only being offered for the diazo process, whilst duplication on silver material is essentially restricted to roll films.

B. 3.1. Silver Film Printers

These are exposing units which are equipped, by means of daylight loading spools, for operation outside dark rooms. The films are exposed in continuous movement, in contact. The working speed is a few metres per minute. Adaptors for 16 mm and 35 mm reels exist. In most cases the films are developed in the same processors as camera-exposed films.

For micro-publications, intermediate positives, especially of microfiche, are also produced manually by exposure in a copying frame and extremely careful developing, because in this field relatively few originals are produced but these must be copied in very large numbers. If the mass copying apparatus is carefully serviced, one can expect to take 200 - 400 duplicates from an intermediate positive. In the case of further copies, losses due to scratches must be expected.

The circumstances are somewhat more favourable in duplicating negatives. The most unfavourable case is undoubtedly roll copying, since here the film is exposed to the most severe conditions.

B. 3.2. Diazo Film Printers

Though all diazo duplicators provide certain functions by virtue of the process, the designs are nevertheless so different that some important forms must be described.

Mercury high pressure lamps are used for exposure. Lamps of low output of a few hundred watt, with arc lengths of a few centimetres, are to be found in roll-to-roll printers for 16 mm and 35 mm, aperture card printers and some microfiche copiers. Since the heating and the power requirement of the motors are kept within reasonable limits, these copies are largely independent of location and can be operated from an electric socket.
(See List 5)

On the other hand high output printers, especially for broad film sizes, have substantially higher electrical ratings and therefore demand special connections.

Diazo films are in most cases developed in a warm ammonia atmosphere. This is produced in a heated chamber which is as well-sealed as possible and into which the ammonia solution is introduced dropwise. In other embodiments, the ammonia-water vapour mixture is produced in an evaporator outside the developer space and the gas is passed in, or dry ammonia gas is taken directly from pressure cylinders.

Particularly in the case of aperture cards, developing in a press, under high pressure, is a standard method. Special films are even offered for this "cold-dry development".

The machines are equipped with a fan for extracting the cooling air and the waste gas. Small units especially for copying aperture cards, also work without venting, and sometime have

an absorber for ammonia. Frequently, the same types are equipped as diazo printers or vesicular printers. The corresponding developer section is inserted into the particular model.

Because of the somewhat different spectral light sensitivity of vesicular films, they employ halogen lamps instead of mercury vapour lamps.

For copying from and onto aperture cards, card-to-card and roll-to-card duplicating printers are offered, including, in most cases, combinations for both methods of working. Roll-to-card printers must be equipped with a magnifying glass or a screen projector in order that the correct image for the copy from the roll film can be selected. On exposure, the individual film frames are brought into intimate contact by means of a pressure pad. Developing takes place by pushing the material into a developer chamber, under pressure or in continuous movement.

For smaller units, the individual processing steps are carried out manually. Large automatic printers are provided with a control system for multiple copying, automatic feed-in and output and, in part, with a duplicating station in which the punched holes of the original card are transferred to the duplicate cards. The customary data processing machines are used for translation of the hole code.

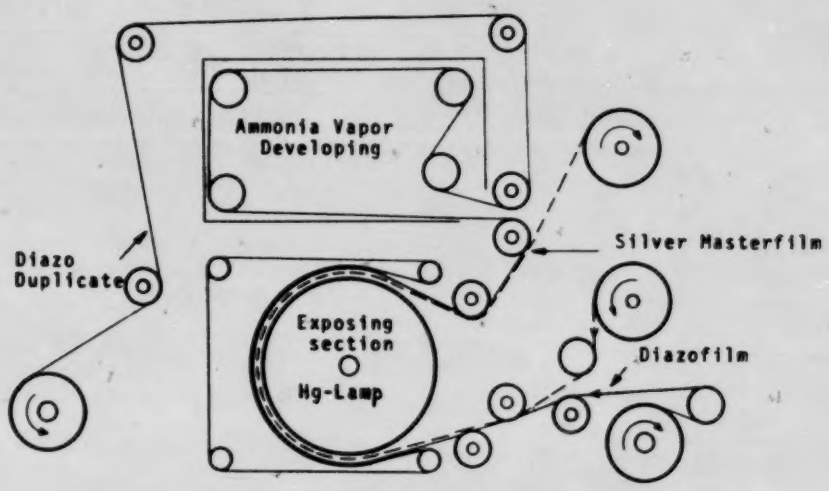
With small units, 4 to 8 cards can be copied per minute. Large automatic units produce 20 or more finished duplicates per minute.

Different exposure methods are offered for microfiche and jacket copies. Some of the copiers are able to provide contact exposure, partly with vacuum, and partly using elastic contact pressure stamps. This type of exposure has the advantage that automatic machines can also be fitted with repeater devices. The original film is then mounted on a mirrorglass plate and the copying material, mostly from a roll, is drawn stepwise under the copying station. This is frequently followed by cutting stations and sorters.

Other machines use exposure in continuous movement, with the light source being located in the interior of a copying drum. This is the same principle as is used in blueprint machines.

Rotary printers have the advantage that long films can also be copied. If the material being copied is well pressed down and an appropriate light source is used, microfiche, jackets, aperture cards and film strips can be exposed in this type of equipment. Developing is carried out in a developing chamber, mostly in continuous movement. Depending on the design of the equipment, 5 - 15 duplicates can be produced per minute.

For roll films, roll-to-roll printers are provided. During exposure, the original film and the duplicating film are passed in direct contact round a drum, using either copying drums with an internal lamp or relatively large discs with lamps externally fitted in a radial position. The diazo film is subsequently passed through the developer chamber, vented and re-wound.



18. Diazo Roll-to-Roll-Printer

In smaller equipment 30 m and 100 m rolls are employed. Large units can hold up to 600 m of film. They are obtainable for duplicating film loops with a repeater device.

Roll duplicating printers have a high output, which is 10 m/minute for the smaller types and up to 40 m/minute and above for large units in repeat work.

The printers are fitted either for 16 or 35 mm film or for copying 105 mm film.

The roll-to-roll copying for vesicular films is run on similar equipment, frequently with even higher copying speeds. However, these are only practical if the original films have a fairly even density. Such is the case, for example, for the COM (Computer Output Microfilm) which are issued as positives, duplicated by the vesicular process and thereby reversed to negatives.

B.4. Readers

The information on a microfilm cannot be read without optical aids. Reading aids are necessary which enlarge the script or project it onto a screen.

In the simplest case, magnifying reading lenses can be used, which are directed towards a source of light after the film has been inserted in them. Reading in this manner is a strain and it is hardly possible to make notes at the same time. On the other hand the magnifiying reading lens has the advantage that it can be used without any source of electricity.

Readers possess a light source which is usually fed from the mains. In some apparatuses it can also be operated with a battery independently of the mains. In older reading equipment, light sources which operate at the full mains voltage are generally provided. Because of the heat which this generates, they require an additional cooling device. Present readers are fitted with low voltage lamps, with halogen lamps being the most widely used. The beam from the light source is directed through a condenser onto the microfilm. The projection image of the microfilm is projected, frequently with interposition of a mirror, either onto a groundglass from behind, or directly onto a white reading surface. In the case of readers with a groundglass, the latter can be either neutral, that is to say colourless, or slightly coloured. This slight colouration, mostly greenish yellow, is intended to counteract premature eye fatigue when working with the reader. In the case of colour microfilms, coloured screens should be avoided since they distort the colour image.

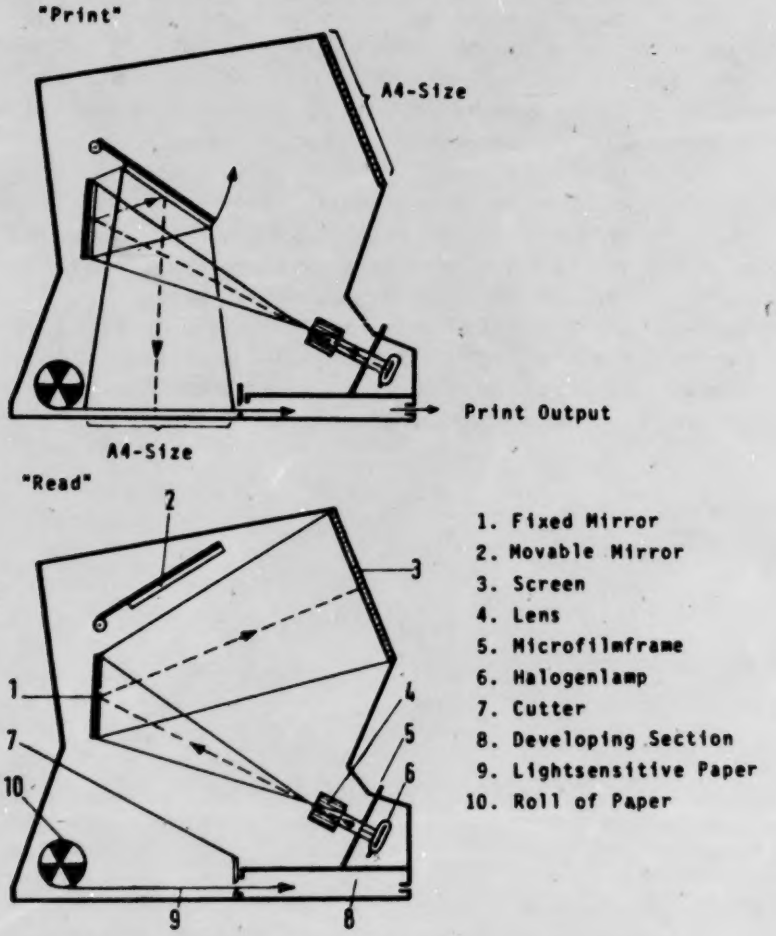
The use of certain types of readers depends on the holder for microforms provided in the apparatus, and on the optical magnifying factors. Each adaptor is only suitable for one form of microfilm, so that a different type of film cannot be evaluated. There are models in which the adaptors for the various forms of microfilm can be interchanged. This is however only to be recommended if the reduction factors and frame sizes of the films to be used are close to one another. If greater versality is required, the lenses and condensing lens must be interchangeable. However, this usually brings one into a price category wherein it might be possible to procure two or more readers for special sizes.
(See List 6)

B. 5. Microfilm-Printers and Reader-Printers

In addition to perusing microfilms on readers, it is necessary to be able to transfer individual pages or more voluminous information onto paper for normal reading, for example, for the further processing of records. Readers with a copying device are available for enlarging individual pages whilst automatic microfilm-printers are available for the enlargement of larger quantities. In the latter, there is usually no provision for reading the microfilm simultaneously.

B. 5.1. Chemical Process

In principle all readers are also suitable for the production of legible copies by projecting the image onto a sheet of light-sensitive material instead of onto a screen. It is particularly simple in the case of readers with an opaque projection screen on which a sheet of copying paper is placed for exposure. For this, the room must be darkened.



1. Fixed Mirror
2. Movable Mirror
3. Screen
4. Lens
5. Microfilmframe
6. Halogenlamp
7. Cutter
8. Developing Section
9. Lightsensitive Paper
10. Roll of Paper

19: Reader-Printer

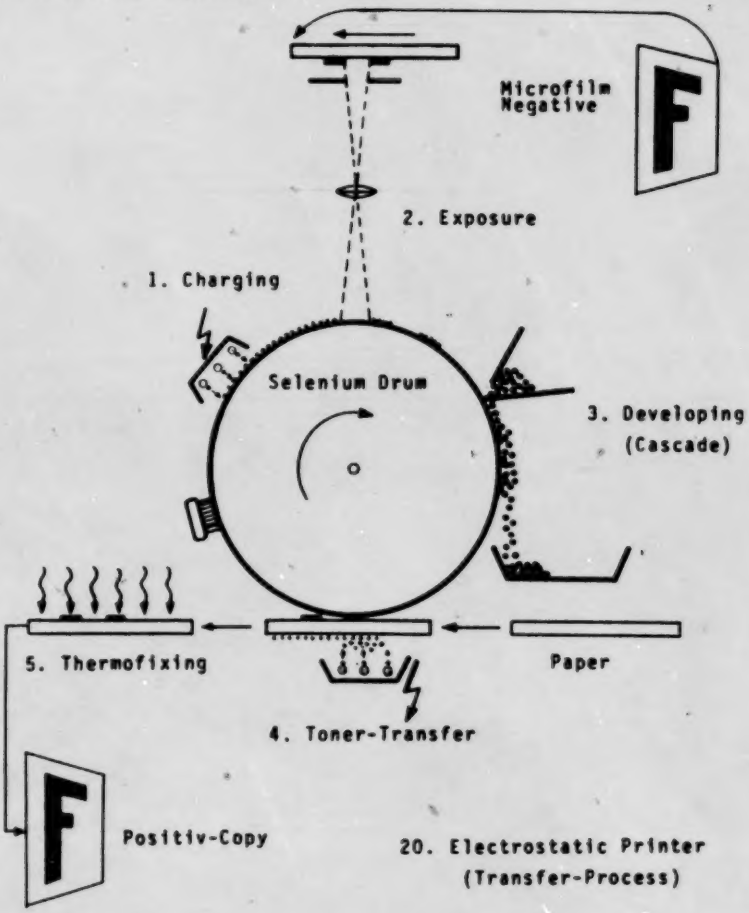
To obatain a right-reading copy using a reader with projection onto a groundglass screen, the path of the beam must be changed by means of a mirror. In most cases, one of the deflecting mirrors is swung from a "reading" position into a "copy" position by pressing a button, and the copying process is initiated. The exposed material is then fed manually or automatically to a duo-bath developer section.

B. 5.2. Electrostatic Process

Instead of silver salt materials, apparatuses can also be equipped with process sections using the direct electrophotographic process with zinc oxid paper.
(See List 7)

B. 5.3. High Volume Microfilm Printers

Large quantities of individual enlargements, complete reports, and long series of documents can only be manufactured economically with special microfilm printers. Xerox have developed the Copyflo-machine for 16 mm and 35 mm roll film. This operates, in various models by the electrophotographic transfer process via a selenium-coated drum onto an uncoated paper web. Since the roll films run continuously, any interval between the microfilm frames is also recorded as a correspondingly large interval on the paper band. Economical working therefore presupposes that the frames are arranged in as close succession to one another as possible.



20. Electrostatic Printer
(Transfer-Process)

One model of the Copyflo also permits the 1:1 copying of A4-documents, in addition to enlarging. The enlargement product is generally a rolled-up paper web. An automatic cutting machine can be located behind the machine only if the frame sequence is completely uniform or if cutting marks for triggering the cutting process have been copied into the film. The copying speed is 6 m of paper web per minute.

For the enlargement of microfiche, a different procedure must be chosen by enlarging frame by frame onto llight-sensitive paper, in most cases a zinc oxide paper. In equipment of this nature, an image sequence of up to 20 copies per minute is possible.

C. Materials

C. 1. Silver Halide Material

C. 1.1. Recording and Duplicating Films

Recording materials of particularly high resolving power are employed at the present time for all microfilm uses. They are in most cases panchromatically sensitized, and their light sensitivity is suited to the light conditions in the microfilm camera. The customary base material is triacetate safety film. The emulsion layer is very thin, about 0.004 mm. Maximum attention is devoted to anti-halation which is aplied directly under the emulsion and not, as is otherwise customary, on the back of the film. All measures serve to increase the resolution. The films have a high contrast and this is assisted further by hard developing in order to obtain lines which are as clear as possible on an even background.

The materials are suited to developing in automatic microfilm processors. It is recommended that only the chemicals named by the manufacturer should be employed, and that the temperatures mentioned for the machines, in most cases 25 - 30° C, should be maintained strictly. Thorough washing is important with a view to ensure the archival quality of the films. The water hardness must be borne in mind. If required, filters should first be fitted into the line.

The films are supplied in daylight loading spools, mostly 30 m long. The packaging is so chosen that the box can also serve as a storage container for completed rolls of film.

Very recently, polyester has been interoduced as a filmbase. Since the films are in most cases thinner, for example 70 µ instead of 140 µ, the contact pressure plate of the camera cassettes must be set appropriately.

Unperforated film is used predominantly.

In special uses, for example for the medical field, colour films are also customary. However, they can at the present time only be processed in the manufacturer's printing labs.

All film materials should be stored cool and dry.

C. 1.2. Enlargement Materials

The coating of silver halide paper is similar to the coating of the silver halide film. Apart

from the difference in the carrier material, the light sensitivity and resolving power are substantially lower in the case of silver halide papers. Instead of paper, lacquered papers, and matt and clear plastic films, can be used as the base.

Usually, high contrast silver halide emulsions are used. For special applications, such as continuous-tone reproductions, medium contrast materials are also offered.

C. 2. Diazo Materials

In all diazo films, the light-sensitive substance is embedded in the plastic. Acetate films are frequently sensitized by diffusion in which case, there is no coating layer present, but the diazo salts are enclosed near the surface of the film material. Polyester films carry a lacquer layer which contains the light-sensitive substances, similarly to the case of acetate film. This layer construction ensures that the film and the copy possess good resistance to mechanical damage.

The copied image consists of an organic dyestuff. The smallest components of the image are the dyestuff molecules. Hence, diazo films show no grain and possess extremely high resolution.

Embedding the image in plastic also ensures that it has good stability for archive purposes and is largely protected against external factors. Thus, for example, rolls of film are not damaged even on exposure to water for a limited time.

Long exposure to a strong light source reduces the contrast of the image. Hence, the copies must be protected against excessive exposure in readers.

Diazo films are offered in all formats, namely as rolls, in sheet film sizes and mounted as aperture cards.

Film thicknesses of between 0.1 and 0.2 mm in the case of acetate , and between 0.05 and 0.2 mm in the case of polyester, are offered for various end uses. The thinner films are envisaged for roll film and cassette inserts and the thicker films mainly all for microfiche indices.

Blue, black and sepia colour shades are preferred as the base film colours. Blue copies give excellent contrast in readers and are therefor provided predominantly for visual evaluation. Black and sepia-coloured duplicates are outstandingly suitable for further copying onto diazo. The black types can be regarded as universal materials since they are suitable for all uses including enlargement.

In general, only two different gradations are offered, of which one will reproduce a softer continnous-tone original better, whilst the other increases the contrast. It is employed for line copies and generally for copying good, uniform original films.

The light sensitivity of all known diazo films differs maximally by only a factor of 2. Hence, practically all materials can be processed on all the different types of apparatus.

For development under pressure with dry ammonia gas at normal temperatures, film grades have been provided in which the requisite moisture is already present in the coating layer.

In contrast to the above mentioned films, vesicular films are always on a polyester base and are in most cases only marketed in thicknesses of up to about 0.12 mm. The film carrier and the thickness limitation are attributable to developing on a heated roller at approx. 120° C being used. The quality and resolution of the film image depends on several factors, namely the type of film, the time between exposure and developing, the developing temperature and the duration of developing. It is always advantageous, in the case of vesicular films, to set the working conditions to an optimum and to change them as little as possible.

Such is the case, for example, with uniform COM films (Computer Output Microfilm). With this type of film, the structure and properties of the image also differ from standard diazo film. The smallest vesicles produce a certain image structure and limit the resolving power. The image has a milky white appearance and is of poor opacity in diffuse light. Hence, vesicular films cannot be directly copied further by the contact method. On the other hand, in the deflected beam of readers and enlargemend projectors the scattered light falls on the objective diaphragm, so that excellent contrast for evaluation results.

The same roll forms, sizes and aperture cards are offered for vesicular films as for diazo films.

C. 3. Electrophotographic Materials

In the case of machines which work by the electrophotographic transfer process, the electrophotography is in effect built into the machine. External controls are restricted to the correct exposure, possibly the charge level, and the subsequent toner treatment.

Of more importance with these machines are the different copying papers which can be employed: Opaque papers, transparent papers and paper printing plates. For practical work, a change from one type of paper to an other requires certain adjustments in the transport system and possibly also a change in the fusing temperature.

In the electrostatic direct process, papers which carry a coating with zinc oxide as the photoconductor are used. The paper base itself is pre-treated so as to possess a good conductivity. Only in this way can good copies, rich in contrast, be achieved.

The copying materials are manually introduced into the reader-printers or into automatic printers or are automatically drawn from stacks of sheets or from rolls. In the case of reader-printers using rolls, a cutting station cuts off the requisite sheet size.

The papers have a very high electrical resistance in the dark and can therefore be charged electically. On exposure, the resistance fades in the areas exposed to the light. The latent electrostatic image can be developed by liquid methods or with dry toner. The latter must be fused in order to fix it.

In electrophotographic papers, correct balance between the process section of the apparatuses and the materials used is very important for good results. For this reason, by no means all papers of the same sensitivity can be used for all printers. Rather, distinct differences are to be found between papers intended for dispersion developing and those intended for dry developing. It is inadvisable to use different materials at random.

The photoconductor layer possesses a specific polar property and therefore it is not possible directly to reverse the polarity of the charge by reversing the polarity of the corona and to switch from a positive to a reversal copy. However, it is just this capability which is very desirable in the documentation field. In most cases, the papers are excellent for one method of working, but only occasionally permit the other type of developing also.

The use of copies as printing plates is desirable. Dry-developed copies are most suitable for this purpose. The requisite wetness control in offset machines is achieved by the use of aggressive chemicals, so-called etch fluids.

Electrostatic papers can be kept extremely well under normal conditions. Their processing requires a certain atmospheric humidity since otherwise fogging of the copy occurs. On the other hand, excessive humidity leads to waviness and difficulties in transport in the machines.

Given good fixing, the finished copies are just as stable for archival purposes as are printed sheets, since all electrophotographic toners are closely related to the customary printing inks.

D. Technology

The following flowcharts are intended to serve as an indication of the organisation of microfilm establishments. They are clasified according to use, that is to say for use

in libraries

in archival work

in information systems

in journalism

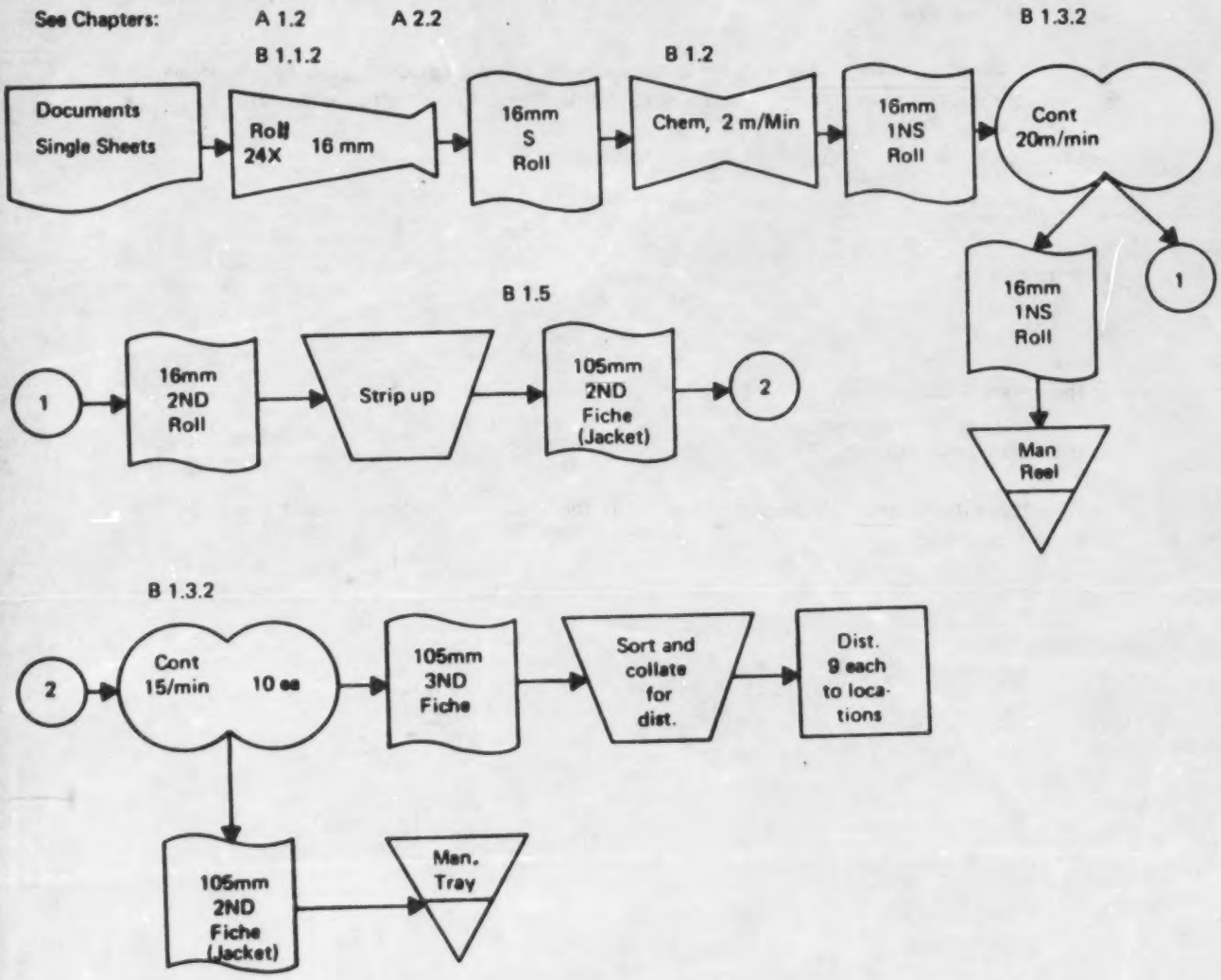
in the patent field and

in the filming of drawings.

In the flowcharts, the chapters pertaining to the individual process stages are cited for reference purposes.

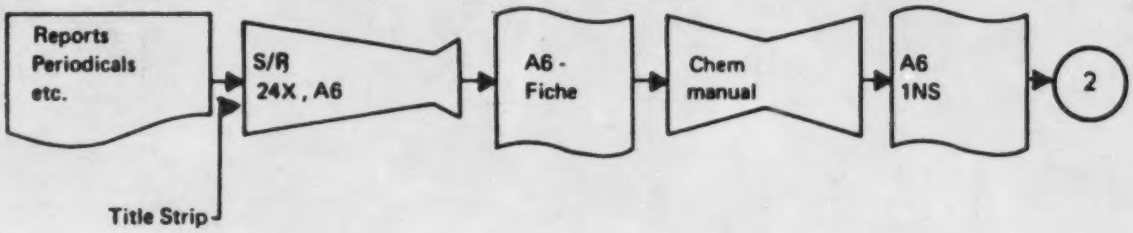
Unitized Microforms: Roll; Jackets

(Flowchart Symbols: see List-Appendix, List No. 16)

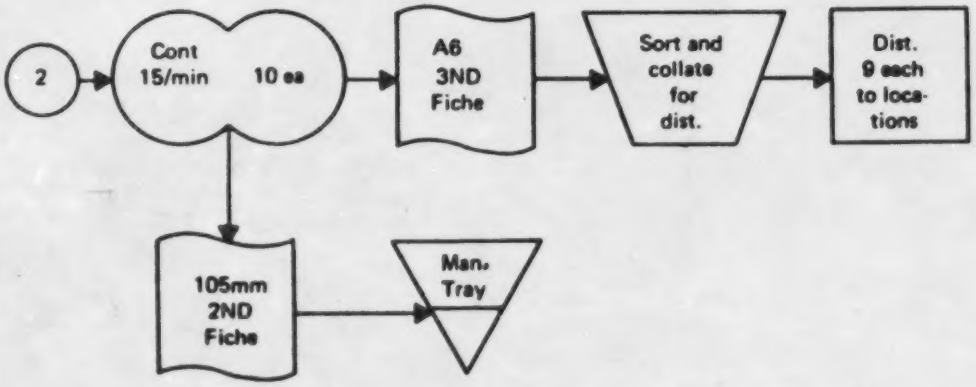


Unitized Microforms: Microfiche-System
(Flowchart Symbols: See List Appendix, List No. 16)

See Chapters: A 1.1 A 1.2 A 2.2
B 1.1.1.2 B 1.2

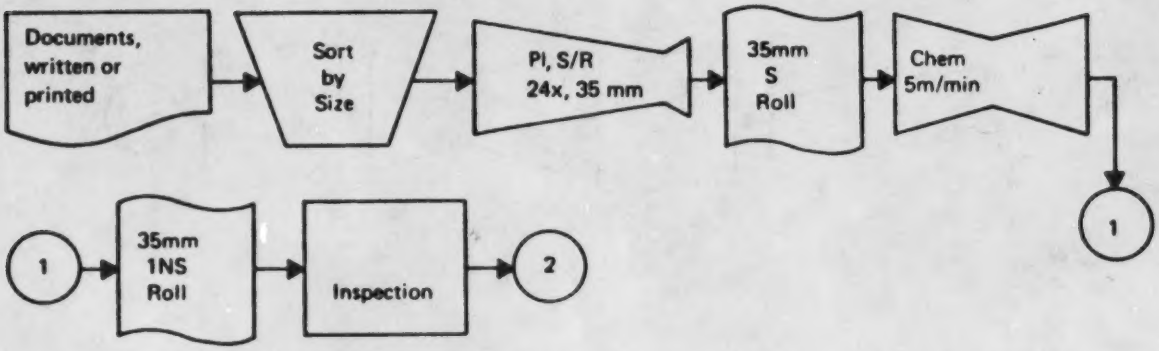


B 1.3

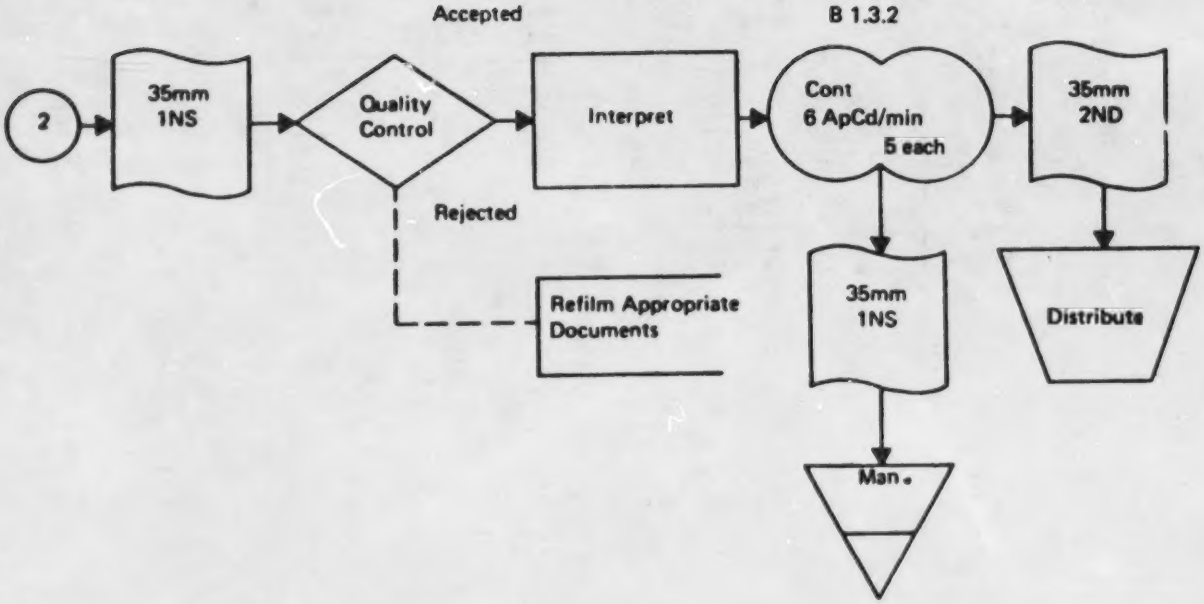


Unitized Microforms: Aperture Card System
(Flowchart Symbols: See List-Appendix, List No. 16)

See Chapters: A 1.1
A 1.4 A 2.2 B 1.2
B 1.1.1



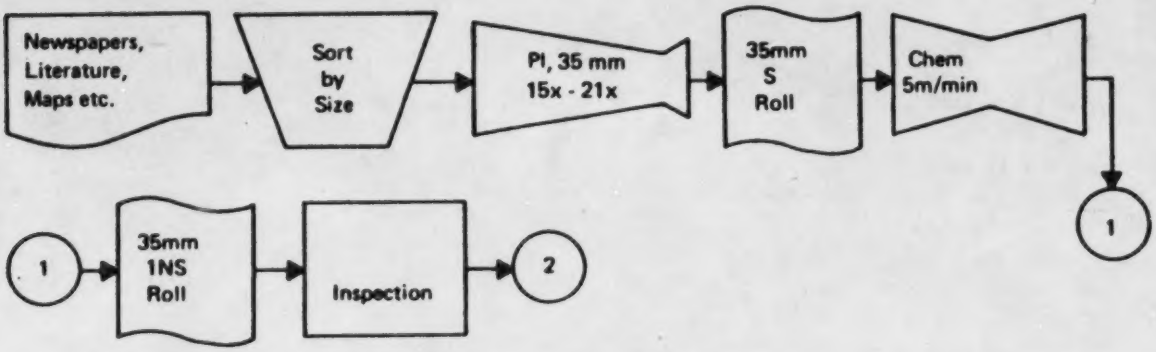
B 1.5

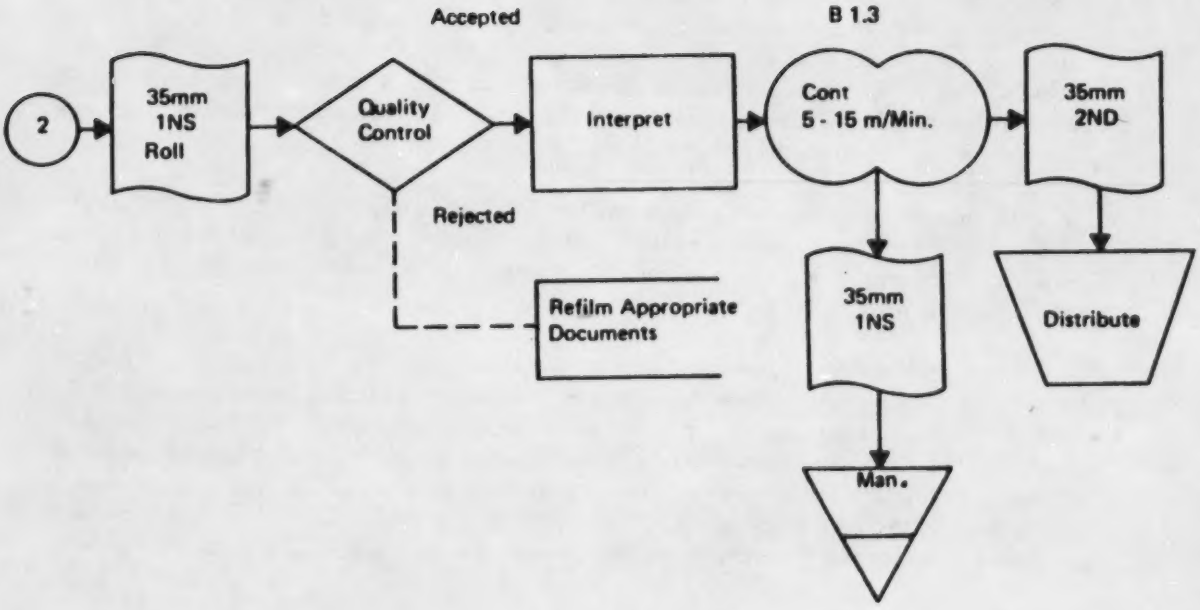


35 mm - Microfilm, Rollsize

(Flowchart Symbols: See List Appendix, List No. 16)

See Chapters: A 1.1, A 1.2, A 2.2, B 1.1.1, B 1.2





E. Standards

If interchange and evaluation of microfilms is to present no problem, standard specifications are essential, namely:

size standards

quality standards

test standards

safety standards and

communication standards.

The nature and objective of the various types of standard specifications will be described in relation to the German standards, since the work on international standards at ISO, in spite of welcome progress in recent time, is unfortunately still far too incomplete to suffice as a guide line for work, and cannot be recommended. The ISO recommendations are listed in the appendix. It must be expected that the greater part of the earlier papers will have to be withdrawn since technical development has taken place in the interim. We therefore prefer to point out the national standards of which those of France, Germany, Great Britain and the United States of America are also listed, as examples, in the appendix.

The basis for mutual communication are the communication standards, which consist of a collection of terms and definitions, for example DIN 19.040 for photographic terms and DIN 19.060 for terms in reprography. The latter have been developed from the "Wörterbuch für Reprographie" ("Dictionary of Reprography") through substantial extension and improvements. The standard specification also contains a list of English terms, so that it represents a specialist dictionary. Currently, a greatly enlarged new edition of the dictionary is being worked on; it is intended to be ready by the next International Congress on Reprography in 1975.

Safety standards for equipment are missing from the list. They are being drawn up on the basis of legal regulations and of the previous technical safety regulations, for example of the electrical industry. In microfilm equipment care must also be taken that they meet electrical and mechanical safety regulations.

The standards for sizes, quality and testing are extensively interrelated in the microfilm field, though attempts have been made to carefully separate the quality standards from the other standards: The quality features are essentially summarised in DIN 19.051. At the same time, however, the individual sheets of this standard specification also describe the test procedure accurately and supplement it with test charts and grey tables. The inter-relation is simply due to the fact that "quality" can only be assessed consistently if the same test procedure is employed throughout. In the German standard specification, the ISO process

for testing the "legibility", which has proved very successful in practice, has been followed with regard to processing the resolution, since the relationship between the smallest script to be filmed and the stylised "e" of the test sign is very clear.

Unfortunately, the multiplicity of original materials which must be filmed reflects not only in different forms of microfilm but also in different "qualities" which have to be demanded. This is understandable if, for example, the requisite resolution in filming printed literature is contrasted with that in the case of type written reports. However, a theme which extends through all standards is the ability to provide good resolution of group 100, that is to say the 1 mm test sign. This corresponds, in the case of 1:25 reductions, to approx. 120 lines/mm. This resolution is undoubtedly achievable with good planetary cameras, but not with rotary cameras.

Probably the most important group of standards is that concerned with sizes. This is so in the microfilm field, if only because the interchangeability and the use of certain types of hardware is directly related to adherence to certain dimensions. A typical example in the negative sense is the various cassette systems in which reading equipment of one manufacturer can only be used with cassettes from this manufacturer. Fortunately, however, the materials consumed have largely been standardised internationally.

DIN 19.050 film reels
DIN 4.518 radiation-sensitive materials
DIN 19.053 aparture cards

In the case of the actual microfilm standards

DIN 19.052 filming of technical drawings
DIN 19.054 microfiche
DIN 19.055 filming of literature

the German work on standard specifications largely agrees with the accepted international customs. There appears to be a good prospect that very shortly ISO standard specifications for microfiche and for filming of newspapers having the same basis will appear.

The standards to be observed in preparing technical drawings appear at first sight not to be related to documentation and library matters. However, they have been, and are, of great importance to the entire subject of microfilming because they are concerned with large sizes which must be greatly reduced and because it is necessary to ensure that every single letter and every number is unambiguously recognisable. This has led to certain types of script having been created and minimum script sizes, minimum line thicknesses and line spacings have had to be prescribed in DIN 15, 16 and 17.

In library work and archives, similar conditions to those for filming drawings and maps will

increasingly be encountered. Furthermore, from the point of view of microfilm technology, the filming of newspapers has a great deal of similarity to the filming of drawings, because of the large sizes involved.

The standard specifications for drawings are furthermore to be used for the production of line originals and diapositives, for which DIN 108 also provides instructions.

Unfortunately, a standard specification on durability and shelf life in archives is still lacking. Here, the thiosulphate determination is still the only method of assessing the photographic film. As regards suitable storage conditions, DIN 15.556 can serve as a basis, though this relates to cinefilm. Since, however, the cinefilm industry has the longest experience in long-term storage of photographic films, the climatic conditions recommended are applicable to roll film archives.

Finally, DIN 19.056 also lists the quality requirements for diazo films which are intended to ensure that duplicates can be employed just as reliably as original films. This is particularly important in the distribution and exchange of scientific reports using micro-duplication.

List-Appendix
List No. 1

Microfilm Planetary Cameras

Manufacturer	Filmsize mm	max. Document Size mm
AGFA-Gevaert AG D - 5090 Leverkusen BRD	16 35	 520 x 570
Bell & Howell Ltd. 7100 Mc. Cormic Road, Chicago 45 Ill., U.S.A.	16	A3
CANON - Camera Co. 5 - 3 Ginza, Chuo-ku, Tokyo, Japan	16	A3; 200 x 220
Eastman Kodak Ltd. Rochester, N.Y., U.S.A.	35 16	AO
Ernst Leitz GmbH D-633 Wetzlar BRD	35 16	A3
Microbox, Dr. Welp GmbH D-6350 Bad Nauheim, Postfach 143 BRD	35	AO
Schaut, Mikrofilm D-6367 Kleinkarben, Fr. v. Steinstraße 8 BRD	35 16	AO
Zeutschel Gerätebau D-7400 Tübingen - Hirschau Würmlingerstr. 11, BRD	35	AO

List Appendix
List No. 2

Step & Repeat - Cameras

Microfiche A6 - Size

Manufacturer	Special features
Bell & Howell Ltd. 7100 Mc. Cormic Road, Chicago 45 Ill., U.S.A.	Built-in titling system Roll 105 mm x 100 ft.
Eugen Dietzgen Co. 218 East 23rd. Street, New York 10, N.Y., U.S.A.	Built-in titling system
Fuji Shashin Film KK Ganza Nishi 2 - 3, Chuo-ku, Tokyo, Japan	Built-in titling system Camera-Processor
Micrographic Technology Corp. 1732 Kaiser Ave., Santa Ana, Calif., U.S.A.	Camera Processor
Minolta Corp. 200 Park Ave., South, New York, N.Y., U.S.A.	Roll 105 x 100 ft.
J. H. Mullens, N.V., Den Haag, Holland	Darkroom necessary
Nederlandse Document Reproductie N.V. Vakriusstraat 28 - 34, Den Haag, Holland	Darkroom necessary

Rotary Cameras 16 mm

Manufacturers

AGFA-GEVAERT AG	D. — 5090 Leverkusen BRD
BELL & HOWELL Ltd.	710 Mc. Cormic Road, Chicago 45 Ill., U.S.A.
EASTMAN KODAK Ltd.	Rochester, N.Y., U.S.A.
REMINGTON RAND SYSTEM Div. of. SPERRY RAND Co.	122 East 42nd Str., New York 17, N.Y., U.S.A.

Microfilm-Processors

Manufacturers	Film sizes, mm
AGFA–GEVAERT AG D-5090 Leverkusen / BRD	16,35
ALLEN PRODUCTS, Inc., Factory Lane, Milford, Cann., U.S.A.	16, 35, 105
BELL & HOWELL Ltd., 7100 Mc. Cormic Road, Chicago 45, Ill., U.S.A.	16, 35
CORDELL Eng., Inc., 210 Broadway, Everett, Mass., 02149, U.S.A	16, 35, 105
EASTMAN KODAK Ltd., Rochester, N.Y., U.S.A.	16, 35, 105
EXTEK Microsystems Inc., 15424 Cabrito Rd., Van Nuys, Calif., U.S.A.	16, 35, 105
HOUSTON FEARLESS Corp. 11801 W. Olympic Blrd., Los Angeles, Calif., U.S.A.	16, 35
HOSTERT - Automata D – 5605 Hochdahl, Röntgenstr. 10	16, 35
IMAGE SYSTEMS, Inc., 11244 Playa Court, Culver City, Calif. 90230 U.S.A.	105

Microfilm-Processors

Manufacturers	Film sizes, mm
ITEK Business Products 1001 Jeffersons Road, Rochester, N. Y. 14603 U.S.A.	16, 35, 105
MEMOREX Corp. 1180 Shulman Ave., Santa Clara, Calif., 95052 U.S.A.	16
MICROBOX, Dr. Welp GmbH D—6350 Bad Nauheim, Postf. 143, BRD	35
REMINGTON RAND SYSTEMS Div. of. SPERRY RAND Co. 122 East 42nd Str., New York 17, N.Y., U.S.A.	16, 35, 70, 105
STROMBERG DATAGRAPHIX P.O. Box 2449, San Diego, Calif. 92112, U.S.A.	16, 35, 105

Microfilm-Diazo-Duplicating Printers

Manufacturer	Filmsize mm	A6 Fiche	Aperture Cards
ATLANTIC MICROFILM Corp., 700 South Main St., Spring Valley, New York 10977, U.S.A.		X	
BLUE RAY Inc. Westbrook Road, Essex, Conn. 06426, U.S.A		X	
CH. BRUNING Co., Div. of A.M. 1800 W. Central Rd., Mt. Prospect, Ill., 600 56, U.S.A.	16, 35		
CANON — CAMERA CO., 5 - 3 Ginza, Chuo-ku, Tokyo, Japan	16, 35	X	
EXTEK Microsystems, Inc. 15424 Cabrito Rd., Van Nuys, Calif. 91406, U.S.A.	16, 35, 105	X	
G.A.F. Corp., Office Systems Div., 140W., 51st. St., New York, N.Y., 10020, U.S.A.	16, 35		X
IMAGE SYSTEMS, Inc. 11244 Playa Ct., Culver City, Calif. 90230 U.S.A.		X	
ITEK Business Products Rochester, N.Y. 14603, U.S.A.	16, 70		X
KALLE AG D-6202 Wiesbaden / BRD	16, 35	X	X

Microfilm-Diazo-Duplicating Printers

Manufacturer	Filmsize mm	A6 Fiche	Aperture Cards
KEUFFEL & ESSER Co. 20 Whippany Rd., Morristown, N.J. 07960 U.S.A.			X
KLEER—VU Industries, Inc., 878 Sussex Bld., Broomall, Pa. 19008, U.S.A.		X	
MICROSEAL Corp., 222 W. Main St., P.O. Box 1386, Evanston, Ill. 60204, U.S.A			X
MINNESOTA MINING AND MANUFACUTRING Co., Box 3800, St. Paul 1, Min. 55119, U.S.A.			X
NB Jackets Corp., 54 - 18 37th Ave., Woodside, N.Y. 11377 U.S.A.		X	X
FREDERIC POST Co., Box 803, Chicago, Ill., 60690, U.S.A.		X	
SCOTT Graphics, Inc., (Technifax) Holyoke, Mass. 01040, U.S.A.	16, 35 70, 105	X	
STROMBERG DATAGRAPHIX Inc., P.O. Box 2449, San Diego, Calif. 92112 U.S.A.	16, 35, 105		

Manufacturers of Microfilm - Readers

AGFA — GEVAERT AG	D — 5090 Leverkusen, BRD
ALOS AG	CH - 8045 Zürich, Grubenstr. 45, Schweiz
ATLANTIC MICROFILM Corp.	700 South Main Street, Spring Valley, N.Y. 10977, U.S.A.
BAYERISCHE REISSZEUG— FABRIKEN GmbH	D — 8500 Nürnberg 28, Brunhildstr. 5 - 9 BRD
BELL & HOWELL	7100 Mc. Cormic Road, Chicago 45, Illinois, U.S.A.
CANON — CAMERA Co.	5 - 3 Ginza, Chuo-ku, Tokoy, Japan
CAPS EQUIPMENT Ltd.	7 Westmoreland Road, London, S.W. 7, U.K.
DASA Corp.	15 Stevens St., Andover, Mass. 01810, U.S.A.
DATA REPRODUCTION SYSTEMS	300 E. Beach Ave., Waltham, Mass., U.S.A.
EUGENE DIETZGEN Co., Inc.,	218 East 23rd Street, New York 10 N.Y., U.S.A.
DOCUMENTATION Inc.	4833 Rugby Ave., Bethseda, Md. 20014, U.S.A.
DUKANE Corp.	St. Charles, Ill. 60174, U.S.A.
FOTOCLARC Friedrich Grün KG	D - 5300 Bonn, Friedrich Ebert Allee 140, BRD
FUJI SHASHIN FILM KK	Ganza Nishi 2-3, Chuo-ku, Tokyo, Japan
G.A.F., Corp., Office Systems Div.,	140W. 51st. St., New York, 10020, U.S.A.

Manufacturers of Microfilm - Readers

EASTMAN KODAK Ltd.	Rochester, N.Y., U.S.A.
MICROCARD Co.	West Salem, Wisconsin, U.S.A
MICROBOX, Dr. Welp GmbH	D - 6350 Bad Nauheim, Postfach 143, BRD
MICRODISPLAY SYSTEMS, Inc.	2 Penn Plaza, New York, N.Y. 10001, U.S.A.
MINNESOTA MINING AND MANUFACTURING Co.	Bos 3800, St. Paul 1, Min. 44119, U.S.A.
MINOX GmbH	D - 6300, Giessen 1, Postfach 137, BRD
National Cash Register Co., Ltd.,	Main and K-Str., Dayton, Ohio 45479, U.S.A.
MICROFILM EQU., Ltd.	GB Colney Hatch Lane, London, N. 1
NOXA Co.	Montruil / France
OPTI COPY Inc.	909 Grand Ave., Kansas City 6, Mo., U.S.A.
Pentacon, VEB-Kombinat KAMERA & KINOWERKE	D 8021 Dresden 21, Schandauer Str. 21, DDR
FREDERIC POST Co.	Box 803, Chicago, Ill. 60690 U.S.A.
PROTI MICROFICHE-READER Co.	Augustijnenstraat 47, Nijmegen, Holland
REMIGNTON RAND SYSTEMS Div. of. SPERRY RAND Co.	122 East 42nd Str., New York 17, N.Y., U.S.A
ROBOT Photo- u. Electronic	D-4000 Düsseldorf-Benrath, Hildenerstr. 57, BRD
SAUL KG, Mikrotechnik	D-6368 Bad Vilbel, Dortelweiler Str. 4, BRD
SCHAUT, Mikrofilm	D-6367 Kleinkarben, Fr.v.Stein-Str. 8 , BRD
ZEUTSCHEL, Gerätebau	D-7400 Tübingen-Hirschau, Würmlinger Str. 11 BRD

List-Appendix
List No. 7

Reader Printer

Manufacturer	Filmsize, mm F = Fiche	Enlargment	Process E = Electrost. S = Silver
AGFA–GEVAERT AG D-5090 Leverkusen, BRD	16, F	20 - 40	E
BELL & HOWELL Ltd. 7100 Mc. Cormic Road, Chicago 45, Ill., U.S.A	16, F	18 - 32	E
CANON – Camera Co. 5 - 3 Ginza, Chuo-ku, Tokyo, Japan	16, 35, F	16 - 30	S
CAPS Equ. Ltd. 7 Westmoreland Road, London, S.W.7, U.K	16, F	20 - 24	E
DASA Corp. 15 Stevens St., Andover, Mass. 01810, U.S.A.	16, F	12 - 40	E
EASTMAN KODAK Rochester, N.Y., U.S.A.	16, 35, F	12 - 38	S, E
FUJI Shashin Film KK Ganza Nishi 2 - 3, Chuo-Ku, Tokyo, Japan	16, 35, F	7 - 27	S
MINNESOTA MINING AND MANUFACTURING Co. Box 3800, St. Paul 1, Min. 55119, U.S.A.	16, 35, F	7 - 35	E
REMINGTON RAND SYSTEM Div. o. SPERRY RAND Co. 122 East 42 nd Str., New York 17, N.Y., U.S.A.	16, 35, F	5 - 40	E
XEROX Corp., XEROX Squ. 024, Rochester, N.Y. 14603, U.S.A.	16	12 - 24	E
ZEUTSCHEL - Gerätebau D - 7400 Tübingen - Hirschau Würmlinger Str. 11, BRD	16, 35	10 - 38	E

List-Appendix
List No. 8

Microfilm Enlarger-Printer

Manufacturer	Microform: R = Rollfilm F = Fiche C = Aperture Cards	Process E = Electrostat. S = Silver (Notes)
CH. BRUNING Co., Div. of A.M. 1800 W, Central Road, Mt. Prospect, Ill. 60056 U.S.A.	R, C	E
KALLE AG D - 6202 Wiesbaden, BRD	R, C	E
KEUFFEL & ESSER Co. 20 Whippany Rd., Morristown, N.J. 07960 U.S.A.	F	S
MINNESOTA MINING AND MANUFACTURING Co. Box 3800, St. Paul 1, Min. 55119, U.S.A.	C	S (Dry Silver)
MEMOREX Corp. 1180 Shulman Ave., Santa Clara, Calif. 95052, U.S.A.	R	E
NATIONAL CASH REGISTER Co., Main and K-Str., Dayton, Ohio 45479, U.S.A.	F	S
Oce van der Grinten Box 101, Venlo, St. Urbansweg 102, Holland	R, C	E
OZALID Ltd. Loughton, Essex, U.K	F, C	E
STROMBERG DATAGRAPHIX P.O. Box 2449, San Diego, Calif. 92112, U.S.A.	R	E (Rotary Unit)
XEROX Corp. XEROX Squ. 024, Rochester, N.Y. 14603, U.S.A.	R, F, C R	E E, (Copyflo = Rotary Unit)

**ISO = International Organization for Standardization,
Technical Committee Documentation,
SC 1 Document Reproduction**

Secretariat ISO / TC 46 SC 1: A F N O R
Association Française de Normalisation
Tour Europe Cedex 7
92080 P A R I S La Défence
F R A N Ç E

Recommendations:

Year	No	
1960	R169	Sizes of photocopies (on paper) readable without optical devices
1961	R193	Microcopies on transparent bases
1961	R216	Trimmed sizes of writing paper and certain classes of printed matter
1961	R218	Scale of 35 mm microfilms for international exchange
1962	R260	Terms relating to microcopies and their bases
1964	R371	Terms relating to microfilm-readers
1965	R435	ISO-conventional typographical character for legibility tests
1965	R446	Microcopies, legibility tests
1965	R452	Essential characteristics of 35 mm microfilm reading apparatus
1968	R689	Microcopies, legibility tests (Reading apperatus)
1968	R782	Measurement of the screen luminance of microfilm-readers
1969	R1116	35 mm and 16 mm, spools and reels

BSI = British Standards Institution

2 Park Street
London WA 2 BS

Great Britain

BS = British Standards

No	Year	
308:—		Engineering drawing practice Supplement No. 1:1967 Preparation of drawings suitable for microfilming
1153:1955		Storage of microfilm
1371:1956		Microfilm readers and reels
1772:1972		Sizes of black-and-white photographic sheet film for general, professional and industrial use
1896:1972		Sizes of reprographic papers
1917:1968		Slides and film strips
2698:1971		Containers and notes for filmstrips
3527:1962		Glossary of terms used in automatic data processing
4187:1967		Microfiches
4189:1967		Conventional typographical character for legibility tests
4191:1967		Essential characteristics of 35 mm microfilm reading apparatus
4210:—		35 mm microcopying of engineering drawings and associated data
		Part 1 : 1967 Recommended procedures
		Part 2 Photographic requirements Section 2.1:1970 Requirements for silver film
		Part 3:1970 Aperture cards and copy cards
4657:1970		Method for determining the resolution obtained in microcopying

AFNOR = Association Française de Normalisation

Tour EUROPE CEDEX 7
92080 PARIS La Défense
FRANÇE

NF = NORM FRANÇAISE

Nr.	
S 20-011	Traitement et conservation des microcopies gelatino-argentiques sur film, destinées a l'archivage
Z 43-030	Microfiche transparente de format A6
Z 43-050	Microcopie des dessins techniques et autres documents de bureau d'etudes

DNA = Deutscher Normenausschuß
D 1 Berlin 30
Burggrafenstr. 4 - 7
W-Germany

DIN = German Standards

Nr./Sheet:		Year	
15	:	1967	Lines in drawings
16/1	:	1967	Standard lettering, sloping style for drawings, generalytis, sizes of lettering
16/2	:	1967	Standard lettering, sloping style for drawings, medium spaced
16/3	:	1967	Standard lettering, sloping style for drawings, close-spaced
17/1	:	1967	Standard lettering, vertical style for drawings, generalytis, sizes of lettering
17/2	:	1967	Standard lettering, vertical style for drawings, medium spaced
17/3	:	1967	Standard lettering, vertical style for drawings, close-spaced
108/1	:	1963	Slide projection, lantern slides, slide films, dimensions, position and marking
108/2	:	1967	Slide projection, lantern slides, film strips; technical slides, drawings, manufacture, testing
198	:	1936	Paper formats according DIN 476, Applications of A-series
406/1	:	1970	Dimensioning in drawings, kinds
406/2	:	1968	Dimensioning in drawings, rules
476	:	1939	Paper formats, A, B, C-series

DIN = German Standards

Nr./Sheet:	Year	
823	: 1965	Drawing, sizes of drawing sheets, scales
4512/3	: 1963	Photographic sensitometry, determination of diffuse transmission density
6 774	: 1967	Engineering drawings: principles of carring out
15 501	: 1970	35 mm motion picture film raw stock dimensions
15 551	: 1962	Motion picture safety film, definitions, test methods, marking
15 556	: 1972	Film for cinematic use: recommended climatic conditions for storage, processing and handling
15 601	: 1967	16 mm motion picture film raw stock, dimensions
19 040/1	: 1970	Photographic basic terms
19 040/2	: 1972	Photographic technical terms in general use, photographic proceedings
19 040/3	: 1970	Photographic technical terms in general use, photographic apperatus and accessories
19 040/4	: 1972	Photographic technical terms in general use, photographic materials and their properties
19040/5	: 1973	Photographic technical terms in general use, general terms of photographic optics
19040/6	: 1973	Photographic technical terms in general use, darkroom equipments
19 040/11	: 1972	Photographic technical terms in general use, overhead projectors
19 050	: 1959	Reels for reprographic use, film 16, 35 and 70 mm
19 051/1	: 1969	Tests for reprographic use, typographical character for legibility tests (ISO-Character)

DIN = German Standards

Nr./Sheet:	Year	
19 051/2	: 1971	Tests for reprographic use, fundamental assembly of typographical characters for legibility tests
19 051/2 Supplement 1	: 1971	Tests for reprographic use, test card for use in practise
19 051/2 Supplement 2	: 1971	Tests for reprographic use, test card for practical use in rotary exposing units
19 051/3	: 1969	Test for reprographic use, test table for microfilming of technical drawings
19 051/3 Supplement	: 1970	Tests for reprographic use, neutral density test cards for use in practise
19 051/20	: 1971	Tests for reprographic use, test negative, original negative, optical density, legibility, permanence
19 052/1	: 1973	Microfilming of engineering drawings on 35 mm microfilm technical proceeding, dimensions
19 052/2	: 1973	technical proceeding of recording
19 052/3	: 1973	reduction ratios for recording on 35 mm film
19 052/4	: 1973	division system of drawing for recording on 35 mm film
19 053/1	: 1970	Microfilm technics, aperture card for 35 mm film, mounting card
19 054/1	: 1969	Transparent microfiche for documentation use
19 055/1	: 1971	Microfilming of documents, technical proceeding of recording for documents written by hand, and for purposes in documentation, library, and archives
19 056	: 1972	Microfilm technics, diazo duplicates, requirements
19 059	: 1972	Microfilms, classification, nomenclature and code signs
19 060	: 1972	Reprographic terms

ANSI = American National Standards Institute

10 E. 40 th Street,
New York 16

New York, U.S.A.

SECTION D — WORK IN PROGRESS ON AMERICAN NATIONAL STANDARDS

NOTE 1: Legend for Type of Review
N — (new) proposed ANS
R — revision of ANS
F — reaffirmation of ANS
W — withdrawal of ANS

NOTE 2: Legend for Status
0 — no activity
C — committee being organized
P — under preparation
V — out for vote
T — draft published for trial
S — submitted to ANSI for approval

Designation/Status	Subject or Title
PH5.1-1959 (R 1970)/0	Microfilm Readers for 16 mm and 35 mm Film on Reels. Specifications for (ISO R371 and R446)
PH5.2-1963 (R 1970)/0	Paper Sheets for Photo-Reproduction of Ducuments. Dimensions for
PH5.3-1967 /RP	16 mm and 35 mm Silver Gelatine Microfilms for Reel Applications. Specifications for (ISO R193 and R260)
PH5.4-1970/0	Storage of Processed Silver-Gelatin Microfilm. Practice for
PH5.6-1961 (R 1970)/V	Micro-Opaques. Specifications for (ISO R260)
PH5.6-1968/0	100-Foot Reels for Processed 16 mm and 35 mm Microfilm. Dimensions for
PH5.7-1964 (R 1970)/P	Micro-Opaque Readers. Specifications for
PH5.8/V	Unitized Microfilm Carriers (aperture, Camera Copy & Image Cards). Dimensions for
PH5.9-1969/RP	Microfiches. Specifications for

SECTION D—WORK IN PROGRESS ON AMERICAN NATIONAL STANDARDS

Designation/Status	Subject or Title
PH5.10-1969/0	Measuring the Screen Luminance of Microfilm Readers with Translucent Screens. Method for
PH5.11/Dropped	Glossary (Abondoned)
PH5.12/V	Method for Measuring Thickness Build-up Area on Unitized Microfilm Carriers
PH5.13/P	Test Chart for Office Copy Machines
PH5.14/V	Standard Method for Determining Adhesion of Protection Sheet to Microfilm Carrier of Aperture Cards
PH.15/P	Permanence of Photocopy Image from Office Photocopiers
PH.16/P	Microfilm Cartridges

Trimmed Sizes, ISO / R 216 — 1961

Main series (ISO — Series)

Subsidiary series (ISO — B Series)

Designation	milimetres	inches
AO	841 x 1189	33.11 x 46,81
BO	1000 x 1414	39.37 x 55,57
A1	594 x 841	23.39 x 33,11
B1	707 x 1000	27.83 x 39,37
A2	420 x 594	16.54 x 23,39
B2	500 x 707	19.69 x 27,83
A3	297 x 420	11.69 x 16,54
B3	353 x 500	13.90 x 19,69
A4	210 x 297	8.27 x 11,69
B4	250 x 353	9.84 x 13,90
A5	148 x 210	5.83 x 8,27
B5	176 x 250	6.93 x 9,84
A6	105 x 148	4.13 x 5,83
B6	125 x 176	4.92 x 6,93
A7	74 x 105	2.91 x 4,13
B7	88 x 125	3.46 x 4,92
A8	52 x 74	2.05 x 2,91
B8	88 x 88	2.44 x 3,46
A9	37 x 52	1.46 x 2.05
B9	44 x 62	1,73 x 2,44
A10	36 x 37	1.02 x 1,46
B10	31 x 44	1.22 x 1,73

Metric Conversion Table

Paper-Sizes, Film-Sizes, Film-Thickness

U.S.A.	International	
Customary English	**Metric**	
Papersize	**Exact**	**Rounded**
3" x 5"	76,2 mm x 127 mm	76 mm x 127 mm
3 1/4" x 7 3/8"	82,55 mm x 187,325 mm	83 mm x 187 mm
4" x 6"	101.6 mm x 152,4 mm	102 mm x 152 mm
8 1/2" x 11"	215,9 mm x 297,4 mm	216 mm x 297 mm
8 1/2" x 14"	215,9 mm x 355,6 mm	216 mm x 356 mm
18" x 24"	457,2 mm x 609,6 mm	457 mm x 610 mm
Film Size		
16 mm x 100 ft.	16 mm x 30,48 m	16 mm x 30,5 m
35 mm x 100 ft.	35 mm x 30,48 m	35 mm x 30,5 m
105 mm x 500 ft.	105 mm x 152,4 m	105 mm x 153 m
4" x 6"	101.6 mm x 152.4 mm	102 mm x 152m
Film Thickness		
.002"	0.0508 mm	
.003"	0.0762 mm	
.004"	0.1016 mm	
.005"	0.1270 mm	
.007"	0.1778 mm	

Reprographic institutions, societes etc.: Abbreviation

AGARD	—	Adivisory Group for Aeronautical Research and Development, Paris/France
AID	—	Association Internationale des Documentalistes et Techniciens de l'Information, Paris/France
ALA	—	American Library Association, Chicago / U.S.A.
ASIS	—	American Society for Information Science, Washington / U.S.A.
ASLIB	—	Association of Special Libraries and Information Bureaux, London / U.K.
ASTM	—	American Society for Testing Materials, Philadelphia / U.S.A.
BAM	—	Bundesanstalt für Materialprüfung, Berlin - West
CAS	—	Chemical Abstracts Service, Columbus, Ohio / U.S.A.
CEA	—	Commissariat a l'Energie Atomique, Paris / France
CERN	—	Organisation Europeene pour la Recherche Nucleaire (European Council for Nuclear Research), Genf / Schweiz
CIINTE	—	Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warzawa / Polska
CNRS	—	Centre National de la Recherche Scientifique, Paris / France
COSATI	—	Committee on Scientific and Technical Information (of FCST), Washington / U.S.A.
COSI	—	Committee on Scientific Information (of FCST), Washington / U.S.A.
COST	—	Congressional Office of Science and Technology (U.S. Government), Washington / U.S.A.
DDC	—	Defense Documentation Center (früher ASTIA), Arlington / U.S.A.
DFG	—	Deutsche Forschungsgemeinschaft, Bonn - Bad Godesberg / BRD

Reprographic institutions, societes etc.: Abbreviation

DGD	—	Deutsche Gesellschaft für Dokumentation e.V., Frankfurt/Main / BRD
DNA	—	Deutscher Normenausschuß, Berlin - West
DOD	—	Department of Defense, Washington / U.S.A.
DSIR	—	Department of Scientific and Industrial Research, London / U.K.
ENEA	—	European Nuclear Energy Agency, Paris / France
EPA	—	European Productivity Agency, Paris / France
EURATOM	—	Communaute Europeenne de l'Energie Atomique, Bruxelles / Belgeum
FCST	—	Federal Council for Science and Technology, Washington / U.S.A.
FIAB	—	Federation Internationale des Associations de Bibliothecaires, Genf / Schweiz
FID	—	Federation Internationale de Documentation, s'Gravenhage / Nederland
GPO	—	Government Printing Office, Washington / U.S.A.
IAALD	—	International Association of Agricultural Librarians and Documentalists, Paris / France
IAEA	—	International Atomic Energy Agency, Wien / Österreich
IATUL	—	International Association of Technical University Libraries, Hannover / BRD
ICA	—	International Council on Archives, Paris / France
ICR	—	International Council for Reprography, Bonn / BRD
ICSU	—	International Council on Scientific Unions, Paris / France
IDW	—	Institut für Dokumentationswesen, Frankfurt/Main / BRD
IFLA	—	International Federation of Library Associations (= FIAB)
INSDOC	—	Indian National Scientific Documentation Centre, Delhi / India

Reprographic institutions, societes etc.: Abbreviation

ISO	—	International Organization for Standards, Genf / Schweiz
IUPAC	—	International Union of Pure and Applied Chemistry, Paris / France
JICST	—	Japan Information Center of Science and Technology, Tokyo / Japan
LC	—	Library of Congress, Washington / U.S.A.
MIT	—	Massachusetts Institute of Technology, Cambridge / U.S.A.
MPG	—	Max-Planck-Gesellschaft, München / BRD
NAS—NRC	—	National Academy of Sciences - National Research Council, Washington / U.S.A.
NASA	—	National Aeronautics and Space Administration, Washingtion / U.S.A.
NBS	—	National Bureau of Standards, Washington / U.S.A.
NESAIS	—	National Federation for Science Abstracting and Indexing Services, Washington / U.S.A.
NLL	—	National Lending Library of Science and Technology, Bosten Spa, Yorkshire / U.K.
NOBIS	—	Stichting Nederlands Orgaan vor de Bevordering van de Informatieversorging, s'Gravenhage / Nederland
NSF	—	National Science Foundation, Washington / U.S.A.
NSEF/OSIS	—	Office of Science Information Service (der NSF)
NTIS	—	National Technical Information Service, Washington /U.S.A
OECD	—	Organization por Economic Co-operation et Development (= OEEC), Paris / France
OSIS	—	= NSF

Reprographic institutions, societes etc.: Abbreviation

OST	—	Office of Science and Technology (= COST)
OSTI	—	a) Office of Scientific and Technical Information of NASA (U.S.A), Washington / U.S.A. b) Office of Scientific and Technical Information of DSIR (England), London / U.K.
OTS	—	Office of Technical Services, Washington / U.S.A.
PAN	—	Polska Akademii Nauk. (Polnische Akademie der Wissenschaften) Warzawa / Polska
PTB	—	Physikalisch-Technische Bundesanstalt, Braunschweig / BRD
RKW	—	Rationalisierungskuratorium der Deutschen Wirtschaft, Frankfurt/Main / BRD
SIE	—	Science Information Exchange, Washington / U.S.A.
TIB	—	Technische Informations-Bibliothek an der T.U. Hannover / BRD
UFOD	—	Union Francaise des Organismes de Documentation, Paris / France
UKAEA	—	United Kingdom Atomic Energy Authority, Harwell, Berks. / U.K.
UNESCO	—	United Nations Educational Scientific and Cultural Organization, Paris / France
VDI	—	Verein Deutscher Ingenieure, Düsseldorf / BRD
VDMA	—	Verein Deutscher Maschinenbauanstalten, Düsseldorf / BRD
VINITI	—	Vsesojuznyi Institut Naucnoj i Techniceskoj Informacii (All-Unionsinstitut für Wissenschaftliche und Technische Information) Moskau / UdSSR
WHO	—	World Health Organization, Genf / Schweiz
WRU	—	Western Reserve University, Cleveland, Ohia / U.S.A.
ZAED	—	Zentralstelle für Atomkernenergie-Dokumentation, Karlsruhe / BRD
ZIID	—	Zentralinstitut für Information und Dokumentation, Berlin (Ost) / DDR
ZLDI	—	Zentralstelle für Luft- u. Raumfahrt-Dokumentation und Information, München / BRD
ZMD	—	Zentralstelle für maschinelle Dokumentation, Frankfurt/Main / BRD

Flowchart Symbols
(See NMA - Industry Standard MS4 - 1972)

Dimensional Ratio
Width: Height = 1:1

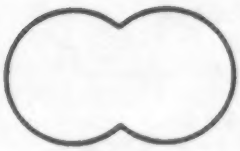
Fig. 1.
All Microforms.

Dimensional Ratio
Width: Height = 1:½

Fig. 2.
Microform Recording.

Dimensional Ratio
Width: Height = 1:½

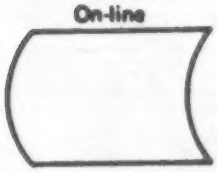
Fig. 3.
Developing.



Dimensional Ratio
Width: Height = 1:½

Fig. 4.
Duplicating.

On-line



Dimensional Ratio
Width: Height = 1:2/3

Off-line

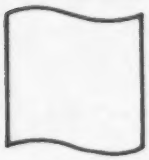
Dimensional Ratio
Width Height = 1 0.866

Fig. 5.
Storage/Retrieval.

Methods for Labeling Symbols to Define Specific Operations, Functions, and Features

This section contains the general information normally required to identify microfilm operational symbols. Additional information required by users to identify symbols in greater depth may be included as required.

Microform Symbol.



This symbol (see Fig. 1) represents any microform used in a micrographic systems flow. Symbolic notations within the symbol itself designate what specifically it represents.

Microform Notations and Sequence. Identifying notations within the symbol and the sequence in which they appear are:

Film Size	(mm)
Generation	(1,2, . . .)
Polarity	(Neg., positive)
Medium	(Silver, diazo, . . .)
Form	(Roll, fiche, . . .)

Microform Symbolic Notations and Abbreviations.

NOTE: Reading horizontally across a line under each "Symbolic Notations and Abbreviations" section, there is no intention to show a relationship, nor does one necessarily exist, between one notation and others on the same line.

Film Size (mm)	Generation	Polarity (Abbr)	Medium (Abbr)	Form (Abbr)
8	1	Negative (N)	Silver (S)	Roll (Roll)
16	|	Positive (P)	Diazo (D)	Fiche (Fiche)
35	2		Vesicular (V)	Aperture Card (ApCd)
70	|			
82.5				
105	|			Jacket (Jckt)
	5			Strip (Strp)
				Chip (Chip)

Example of Labeled Microform Symbol With Notations in Proper Sequence.

Fig. 6.
Example of Labeled Microform Symbol With Notations in Proper Sequence.

Flowchart Symbols

Microform Recording.

This symbol (see Fig. 2) represents the recording function of transferring information to an original microform master.

Microform Recording – Notations and Sequence. Identifying notations within the symbol and the sequence in which they appear are:

Method (Rotary, Planetary, . . .)
Reduction (12X, 24X, . . .)

Microform Recording – Symbolic Notations and Abbreviations.

Method	(Abbr)	Reduction
Rotary	(Ro)	12X
Planetary	(Pl)	
Step/Repeat	(S/R)	24X
Computer Output Microfilmer	(COM)	
Scanner	(Scan)	150X

Developing.

This symbol (see Fig. 3) represents the developing process for making information or a medium permanent and/or readable by man or machine.

Developing – Notations and Sequence. Identifying notations within the Developing Symbol and the sequence in which they appear are:

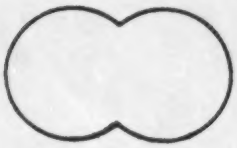
Method (Chemical, Heat)
Rate (Meters/Minute, . . .)

Developing – Symbolic Notations and Abbreviations.

Method	(Abbr)	Rate (Abbr)
Chemical	(Chem)	Meters/Minute (m/min)
Heat	(Heat)	Item/Minute (Item/min)

Flowchart Symbols

Duplicating.



This symbol (see Fig. 4) represents the making of single or multiple copies of a document or microform, usually with the aid of a master or intermediate.

Duplicating – Notations and Sequence. Identifying notations within the Duplicating Symbol and the sequence in which they appear are:

Method (Contact, Optical)
Rate (Meter/Minute, . . .)

Duplicating – Symbolic Notations and Abbreviations.

Method	(Abbr)	Rate (Abbr)
Contact	(Cont)	Meter/Minute (m/min)
Optical	(Opt)	Item/Minute (Item/min)

Storage/Retrieval (Existing ANSI Symbols).

This symbol (see Fig. 5) represents an input/output operation utilizing any type of on-line storage.

This symbol (see Fig. 5) represents the storing of information off-line, regardless of the medium on which the information is recorded.

Storage/Retrieval – Notations and Sequence. Identifying notations within the Storage/Retrieval Symbols and the sequence in which they appear are:

Method (Manual, Semi-Automatic, . . .)
Rate (Items/Unit of Time)
Container (Cartridge, Cassette, . . .)

Storage/Retrieval – Symbolic Notations and Abbreviations.

Method	(Abbr)	Rate	Container	(Abbr)
Manual	(Man)	Items/Unit of Time	Cartridge	(Cart)
Semi-Automatic	(S-Auto)		Cassette	(Cass)
Automatic	(Auto)		Cell	(Cell)
			Magazine	(Mag)
			Reel	(Reel)
			Stick	(Stk)
			Tray	(Tray)

Literature

H.J. Funck, Moderne Mikrofilmsysteme, Monatliche Phototechnische Mitteilung 13 (1965) Seite 248 - 250

H.J. Funck, Mikrofilm: Informationsträger Organisationsmittel, Reprographie 11 (1971) H.1/2, S.9-17

H. van der Hurk, Technik des Mikrofilms, Reprographie 11 (1971) H. 1/2, S. 19 - 29

R. Lambeck, Die Auswässerungskontrolle bei der Verarbeitung photographischer Materialien. Reprographie 10 (1970) H. 5, S. 116 - 21

Makovec, Umkehrentwicklung von Dokumentenfilmen, Monatliche Phototechnische Mitteilung 9 (1961) Heft 4, Seite 142 - 143

H. Müller, Der aktive Mikrofilm als Übertragungskette, Reprographie 5 (1965) Heft 3, Seite 51

H. Müller, Mikrofilm-Vervielfältigung mit Ozalid-Duplizierfilm Reprographie 9 (1969) H. 1, Seite 9 - 15

R. Müller, Die Schärfeprüfung von Filmen in Verbindung mit Fragen der Dokumentation, Reprographie 5 (1964) Heft 5, Seite 97 - 100

R. Reuther, Über die Bildqualität bei starker Verkleinerung in der Mikrofilmtechnik Zentralinstitut für Information und Dokumentation (ZIID) 11. Kolloquium Dresden 26.2. - 27.2.1970 Teil 1 Seite 161 - 169

A. Schulze, Die Ursache von Dichteschwankungen auf Mikrofilmnegativen. Reprographie 9 (1969) Nr. 2, Seite 33 - 34

A. Schulze, Dichte und Vergrößerbarkeit von Mikrofilmen, Reprographie 5 (1965) Heft 4, Seite 73 - 78

A. Schulze, Lesbarkeit und Auflösungsvermögen in der Mikrofilmtechnik. DIN-Mitteilungen 49 (1970) H. 1, Seite 25 - 27

S. Sollorz, Mikrofilm in der Medizin, Reprographie 10 (1970) Nr. 6, Seite 150 - 151

G. Thiele, Das Microfiche, Anwendung und Technik. Nachr. Dok. 22 (1971) Nr. 1, Seite 33 - 37

H.-J. Thiessen, Die Dichtemessung von Mikrofilmnegativen, Reprographie 6 (1966) Nr. 11, Seite 174 - 177

-----, Wörterbuch der Reprographie (deutsch - englisch, englisch - deutsch) herausgegeben zum 2. internationalen Reprographie-Kongreß 1967 von der Deutschen Gesellschaft für Dokumentation, Frankfurt/Main